9: Yamasaki--224-225 N-5 (1896-1897) 1900 Formosans
116, 133

All these volcanoes are situated on the right side of the lower Tamsui-kei. Near the mouth of this river, opposite the harbor town of Tamsui, there rises up on the left hand side the isolated volcanic cone of Kannon-san. It is only 566 m. high, and its shape is not so complete that its crater can be made out exactly. The lava in all this volcanic region is only andesite, very similar to that on the [225] other Japanese islands. The lava of the Shichiseiton-san is a rather pumice-like, light brown amphibole andesite, while all the others consist of pyrozene andesite, with structures and colors that differ from each other, as is usually the case.

Older, unstratified rocks are very poorly represented on the island. Granite is almost unknown; but Dr. Ishii writes that a small piece of this rock was found by his colleague to the north of Karenkō. Granite, which is frequently used as a building material in towns of the interior as well as in many harbors, is imported from China. Serpentine was found in some small areas in East Taiwan. Diorite gravel was collected on the Taikokan-kei (upper course of the Tamsui-kei) and also on some tributaries on the left side of the Dakusui-kei.

Quite a number of hot springs have been found in different parts of the island, and not only in volcanic regions. They are indicated on the map (Plate 19). [MC: see source, page 298, plate 19, for map]

9: Yamasaki--225 [2] N-5 (1896-1897) 1900 Formosans 116, 133

The large plain of Taiwan forms the western part of the island. The alluvial soil is fertile and there are many towns and villages in all quarters of the plain. With regard to situation and nature we must separate the narrow northern part of this coastal land from the southern. The former is a plateau and consists in the main of rubble, clay and laterite. On the east coast we have also seen its origin, on one occasion, by the direct alteration of clay slate.

9: Yamasaki--225 [3] N-5 (1896-1897) 1900 Formosans
116, 133

A remarkable terraced table-land joins the northern plateau on the south and stretches in the direction of the meridian, from about 60 kilometers' distance from the Taikō-kei, to the Dakusui-kei. On its western side the table-land rises rapidly over the plain to between 200 and 500 m., while on the eastern side there is a much lesser and a gradual decline to the foot of the Tertiary hills. From east to west it thus has a long, cuneiform profile, and it consists of an extremely plentiful Pleistocene deposition of gravel, which is covered by laterite. I consider it to be the old coastal terrace. The tributaries of the Taito-kei flow through this territory [MC: the terraced tableland in the south] like a network. The soil is very fertile; but the town of Taichū (Taiwan-fu) situated here is notorious for malaria.

9: Yamasaki--225 [4] N-5 (1896-1897) 1900 Formosans
116, 133, 361

The middle and southern parts of the western coastal territory of Taiwan begin at the lower course of the Hōri-kei and stretch to the little town of Hōryō towards the south. The whole length of this plain is 220 km, and its greatest width is 48 km. It is heavily populated and has many towns, e.g. Kagi (Kia-ji), Taikō (Taikia), Unrin (Jünlin), Shōka (Tschang-hwu), Rokkō (Lokiang), Tainan (Tainanfu), Hōzan (Fŏng-schan), Takao (Takau), etc. In the north there is the small basin-shaped plain of Taihoku, watered by the Tamsui-kei and its tributaries. The capital of Taihoku (Taipei), with its commercial suburbs of Taitōtei (Tautuatea) to the north and Banka to the southwest, lies in the middle of the plain. There is also a small plain with the little town of Kōshun (Höngschŏn) at the southern end of the island.

9: Yamasaki--225 [5] N-5 (1896-1897) 1900 Formosans 116, 133

On the east coast we first find the so-called Capsiulan Plain in the neighborhood of the town of Giran (Ilan). Between the central shale range and the volcanic coastal chain the longitudinal valley already mentioned forms a narrow, long plain, which widens out in the north to form the plain of Kirai and in the south to form that of Pinan. Lengthwise, it stretches from Shinjō to Chipon.

Finally, mention will be made here of an interesting depression in the middle of the island, where the 121st meridian crosses the 21st parallel. Through it flows the upper course of the Hokkō-kei, a tributary on the left bank of the Taito-kei. Probably it was formerly a lake basin. We shall name it the Horisha Basin, after the little town of Horisha situated there. To the south of this, in a wonderful landscape, lies the largest inland lake on Taiwan, called Suisha-ko, and for a long time past known to Europeans as "Dragon Lake." On the eastern shore there rises the thickly wooded Suisha-san, 1896 m. high.

"Topographically, the island may be divided into two parts—an eastern mountainous region and a western plain. By elevation the whole area is divided as follows:

| Elevation (in metres) | Area of the island (in sq. mi.) | % of total |
|---|---|---|
| 100—500 m. (328—1,640 ft.) | 2,900 | 21.0 |
| 500—1,000 m. (1,640—3,281 ft.) | 2,960 | 21.4 |
| 1,000—1,500 m. (3,281—4,921 ft.) | 1,560 | 11.6 |
| 1,500—2,000 m. (4,921—6,562 ft.) | ,670 | 4.7 |
| 2,000—2,500 m. (6,562—8,202 ft.) | 370 | 2.7 |
| 2,500—3,000 m. (8,202—9,842 ft.) | 180 | 1.3 |
| over 3,000 (over 9,842 ft.) | 100 | .7 |
| Total | 13,810* | 100.0 |

* 8,838,000 acres.

[5] Thus 21 percent of the total area of the island rises above one km. and 4.7 per cent—above two km. There are in Taiwan seventy-nine summits of the two parallel mountain ranges traversing the country from north to south, which rise above 3,000 m. Of these Mt. Niiaka (or Morrison), —rises to 3,950 m. (1) and Mt. Tsugitaka (or Sylvia)

1. 3,950 m., a figure given in Taiwan Jijo, equals 12,956 feet. However in the Japan Manchoukuo Year Book, 1939, as well as in some other books, its height is given as 14,500 feet.

to 3,931 m.; both of these (and several others) are higher than the famous Fujiyama of Japan. The ranges of mountains, rising one above the other over the western plain from sea level to a height of four km. over a short distance of eighty km. and then falling abruptly to the sea in the east, present a majestic and fascinating picture and justify the name given to Taiwan by the Portuguese—Formosa (Beautiful). In many places on the east coast magnificent cliffs form an almost perpendicular rock wall 500 to 150 m. high. Only one-third of the island is plain; the other two-thirds are hills, valleys and mountains, a fact which limits the area of cultivation. The mountainous eastern part, covered with thick tropical forest, has become a place of refuge for the aboriginal tribes."

4:Grajdanzev--7 [2] S-4 (no date) 1942 Formosans
116, 133, 376

"Because of topographical conditions, the rivers of Taiwan are short and swift, the longest being the Dakusui, 170 km. (105 miles) long, which is in the east and flows parallel to the coast. There are only five others longer than 100 km. As they descend rapidly from great heights to the plains, however, they are able to supply a huge amount of power for the production of electricity, an important factor in the prospective industrial development of Taiwan."

4:Grajdanzev--8 S-4 (no date) 1942 Formosans
116, 133, 731

"Situated in the Pacific belt of volcanoes, Taiwan has very many earthquakes, on the average 330 each year in various parts of the island, but few are of great violence. In the earthquake of March 17, 1906, 3,643 persons were hurt and 20,987 houses damaged; on April 21, 1935, 15,329 persons were hurt and 54,688 houses damaged."

6: Kirchhoff--25 [2] U-4 (no date) 1895 Formosans
116, 133

On the west coast [MC: of Formosa] the land is extending out into the sea with astonishing rapidity, so that the lagoons in the southwest frequently indicated on our maps became dry long ago. The site of the locality of An-ping, near the largest town on the island, Tai-nan (formerly Tai-uan-fu), formed a small island in the 17th century, according to contemporary Dutch maps, opposite the coast of the main island. Deposits made by the sea and the rivers will scarcely suffice to explain the addition of dry land to the consistently flat west coast, with sandbanks constantly arising afresh from the surrounding shallows; it probably depends, for the most part, on a slow but ceaseless uplift, for whose activity on the north coast we have the witness of von Richthofen (Zeitschrift der Deutschen Geologischen Gesellschaft 1860, Vol. 12, pp. 540 & 545). The east coast, mountainous almost everywhere, sinks steeply into the deep sea and shows no signs of growth.

The smaller western half of the island is for the most part low-lying, and is plain in part, but only to a breadth of between 32 and 40 km., and in part hilly country; the larger eastern half for the most part is filled with mountains.

The longest of the Formosan mountain chains is in the direction of the longitudinal axis of the whole land, that is from southwest to northeast. Generally one speaks of a "high central chain" said to run along the whole length of the island. But there is none of this extent. Only where the island attains its greatest breadth does there seem to be such a central chain, approximately equidistant from the two coasts and in the direction mentioned. It is designated by the name of Ta-schan ("Large mountain range") among the Chinese settlers (almost the whole of our nomenclature for the island coming from their language and not from that of the natives). Imbault-Huart was obviously systematizing far too much when he asserted that the central chain covered almost the whole island from north to south, the lateral chains joining it at right angles like fish bones, while the central chain broke up only in the north into several subsidiary chains equal among themselves and like crow's feet. Consequently he often uses the term "central chain" for the mountainous region filling all eastern Formosa. This is a misuse of the term. The other feature he indicates seems much more exact, [26] namely that the "central massif" (a very vague area of the "Ta-schan") consists of several chains of very unequal height throughout their lengths and divided by deep valleys, which present steep wall on the east coast and gradually sink down towards the western plain; in the north shorter and lower ridges running in various directions constitute the Formosan Switzerland (which has a very doubtful right to this name); along the coasts of the southern

tongue of land parallel lines of hills run along the coast to form two headlands between which there lies the bay of Kûeî-leang, a much sought haven of refuge for ships during the northeast monsoon.

This latter description also corresponds rather better to the map Imbault-Huart provided with his book. On it the Ta-wu-man-schan ("Range of the Great Hero") comes closest to the notion of a central chain, for it represents a long-stretching chain in the position and direction already mentioned; these chains are said not to run at the same height, like walls, but to undulate greatly, varying between several thousand and a few hundred meters; the small Dragon Lake at the eastern base of the main chain is given a height of 1,000 m. The highest peak of the whole island, the Jü-schan ("Jade Mountain"), the Mount Morrison of the English, rises in a shorter eastern neighboring chain; since it remains covered with snow until late in the summer, it probably attains a height of at least 4,000 m.; it is credited with a height of 4,280 m. Farther to the north there follow tablelands "1,000 m. high," beyond which rises the majestic cone of the Thoa-sia, the Sylvia Mountain of the Europeans, to an alleged height of 3,766 m. * In

* According to the English coastal survey on the "Sylvia" (which gave its name to the mountain), the height is more than 13,000 feet, i.e., about 4,000 m.

the north, and close to the coast at the left side of the Tam-sui estuary, rises the Kuan-yn-soan (Soan is an alternate form of Schan ("mountain, Mountain range"), so often met with. So called from its resemblance to the sitting goddess Kuan-yn, it is surrounded by lower peaks, which are called Lo-han ("The Wise Men"), the retinue of the goddess. The Ta-tun Range rises higher on the right side of the Tam-sui estuary; it runs towards the northeast, and an S continuation of it is formed by the 1,000 m. high Ta-tun-soan, a volcano that apparently is not yet extinct; the crater at the peak, which is transformed into a lake in the rainy season, is 150 m. deep and about 300 m. in diameter; some decades ago it is said to have emitted a stream of sulphur to the accompaniment of earth tremors. Behind the Ta-tun chain the Tschao-soan ("Volcano Peak") rises quite isolated to a height of 1,330 m.; it has several extinct craters and is the highest peak in the north of Formosa, looking to the sea on one side and towards the Sylvia giant on the other. Along the northeast coast there runs the Ki-lung Range, with fantastic cliff shapes with obelisk-like and flattened tops, and through whose narrow gorges burble mountain streams; the bay of Ki-lung Harbor itself is formed by a gorge-like gap in this chain. The island of Ki-lung, which is a volcanic rock 200 m. high, stands like a watchman in front of the harbor entrance.

In the southwest of Formosa, the Chinese geographers include in the Ta-schan the Mu-kang-schan ("Forest Range"), a steep chain that rises into the clouds, and the

rampart-like Ta-kang-schan. Southwards from the latter lies the Siao-kang-schan ("The Small Range"), consisting of two mountains only, one an important landmark for sailors, when they wish to set out for Formosa from the coral Pescadores or Fisher Islands, the Pung-ho of the Chinese. In the neighborhood of the town of Fung-schan there rises the ridge to which the town owes its name ("Phoenix Mountain"); the Chinese see in it the shape of a flying phoenix.

Finally, in the southeast, there are two higher ranges: the Kuef-lef-schan (Kia-lo in the natives' language), between 1,200 and 1,300 m. high, and the Pi-nan-mi-schan, which is covered with firs.

6: Kirchhoff--26-27 U-4 (no date) 1895 Formosans
116, 133, 135

Slight and fragmentary is our knowledge of the soil composition and the geology of Formosa. The two coastal mountains at the mouth of the Tam-sui are trachytic, and the proof of considerable recent variations in elevation is given by layers of pebbles and mussel breccia on its slopes high above the actual sea level. The Ki-lung Range consists of sandstone with intercalations of extensive coal beds. The presence of Miocene and Pliocene Tertiary formations has also been shown, and particularly in the north of the island recent, indeed continuing volcanic activity. It still remains to be examined how much faith can be set on Chinese reports of "nightly gleams of fire" as phenomena of volcanic eruption, even in the mountains of the southeast. But Formosa, beyond any doubt, belongs to the great Eastern Asiatic Belt with still persisting volcanic phenomena. Deposits of sulphur and solfataras are found in considerable numbers in northern Formosa; in many places there steam forces its way hissing out of the ground, generally mixed with sulphur gases, at times as a steam hole. In addition to genuine geysers, [27] steam holes send up white pillars of vapor to a height of 8 to 10 meters from the fissures of the Tschao-soan.

6: Kirchhoff--27 U-4 (no date) 1895 Formosans
116, 133

Earthquakes are frequent, particularly towards the end of the year. The terribly destructive earthquake of 1782, accompanied by bad weather, lasted for 12 hours. The equally destructive earthquake of 1654 began with frightful shocks on December 14 and, with short intervals, lasted for three weeks, one witness assuring us that the ground trembled without ceasing for the three weeks, as could be easily seen from the oscillating of the water surface in filled vessels. According to Chinese statements, the district of Kia-y (in the southwestern part of the island) is now especially subject to earthquakes.

116, 103, 133

Formosa suffers from a shortage of large rivers that are always navigable; in Chinese all the Formosan rivers are called, not kiang or ho, but ki ("stream"). Most of them become a trickle in the dry season or dry up altogether, their beds then being used for land transport. Yet in the rainy season they carry such a mass of material in precipitation that their mouths are ever and again being blocked by shifting sandbanks. Consequently larger ships cannot travel up any river at all; even the keelless junks do not dare to risk crossing many of the bars; these are then crossed on curious bamboo rafts, called Katamarans.

The only better known river system is that of the Tam-sui, as Europeans say ( in Chinese it is called Tan-tschui-ki, "Stream of Fresh Water"). It arises from the junction of the Tokoham and Sintiam Rivers and below this is navigable for larger junks; on the right it also receives the Ki-lung River, which has its source at the Ki-lung-schan and, in spite of its numerous rapids, is traveled on by curious boats with quite flat bottoms that are 10 m. long and 2 m. wide. *

* The branch of this river leading to the harbor of Ki-lung, and which looks like a bifurcation, does not exist, and was given on Imbault-Huart's map by mistake.

The name of Tan-tschui-ki is also borne by the only large river flowing towards the

south, and which enters the sea near Fung-schan. Near Tai-nan Ta-mu-ki makes its way to the sea through the stretch recently regained; it originates in several mountain brooks. But the largest river in the west is said to be the Niëu-tschao-ki which flows to the south of the town of Kia-y. It is quite broad, particularly towards the mouth, but is difficult of navigation because of its shallowness and many sandbanks. ** The

** Neither Imbault-Huart's map nor that of Hosie indicate this river.

rivers on the eastern side of the island are naturally only raging mountain streams.

Lakes are rare; yet the western low-lying land also possesses some, which we have not been able to enter on the map, owing to a lack of exact indications. There are also said to be small, cauldron-shaped crater lakes.

6: Kirchhoff--29 U-4 (no date) 1895 Formosans
116, 133, 136

After all this [MC: evidence of the similarity between the fauna of Formosa and the mainland] one will probably agree with Wallace's final conclusion that while Formosa is an island detached from China, this separation from the mainland must have occurred pretty early, though certainly during the Tertiary period. Further, not only did many species of animal on the island vary, the insular isolation preventing crosa-fertilization with unaltered species, these varieties gradually becoming new species, but at the same time great changes were experienced in South China with respect to fauna, so that the relations to the Indian domain were more and more obliterated. It would be of value to subject this explanation to a more searching test, by means ,for example, of paleontological discoveries in the soil of southern China. The beetles and butterflies of For - mosa also diverge from those of the Chinese mainland, while they are related to and in part identical with those of Hainan and the Malayan island region; but these creatures might have been transferred by the typhoons that frequently blow over the island from a southerly direction (Hosie, p. 6).

The more important localities in Formosa all arose as centers of the export trade, and are thus either harbors or at least are situated close to the coast.

The most remarkable degree of development has been attained by Tai-nan, formerly known as Tai-uan or Tai-uan-fu. It now lies more than 3 km. distant from the coast and away from the right bank of the Na-mu-ki. But as late as the 17th century the wide plain between the town and the sea, which is now traversed by creeks and in which there are many fishponds, was a stretch of the sea, and today it is still flooded every year by the southwest monsoon. At the place where nowadays the creek flowing westwards from the town widens out to form a broader stream, more resembling a river, there lies the rather higher ground that bears the village of An-ping, 2 1/2 km. from the town and close to the shore of this creek, which continues on in a southwesterly direction for another kilometer, offering anchorage to junks of shallow draught and finally joining the sea after traversing a shifting sandbank. This hilly ground on which is An-ping measures 1 km. from east to west and 1/2 km. from north to south; it still rises like an island amidst river arms and swampy plains, and is the already mentioned former coastal island of Tai-uan, its name then being given by the Chinese to the whole island of Formosa. At that time, when from 1630 to 1633, the Dutch built their fort of Zelandia, the longitudinal axis of the sandy islet (it was narrower also in those days) ran from southeast to northwest, forming the partial barrier against the open sea of a lagoon bay cutting more deeply into the body of the main island; in the north the entry

to the lagoon was always open, via a broader channel of the sea, and in the south a sandbank one could walk on at low tide already began to connect the isle to the main island.

6: Kirchhoff--35 U-4 (no date) 1895 Formosans
116, 133, 175, 361

On the eastern side of the lagoon of Tai-uan lay the small locality of Sakkam (in Chinese: Tsche-kan), a native village of about 100 houses. In front of this the Dutch erected another fort, called Provintia or Providentia, exactly opposite Fort Zelandia, so that the lagoon was dominated on either side. After the collapse of Dutch power in Formosa, Zelandia still remained the key to the entry of the lagoon, behind which little Sakkam had grown to be the most important trading center on the island. For this reason Koschinga made it his residence and the Chinese, when they took possession in 1683, made it the seat of government and consequently called it Tai-uan-fu. But the continued growth of sandbanks that gradually rose above sea level, to the west of Fort Zelandia, made this fort useless as a coastal protection, so that it was dismantled in 1874 and a new fort built of its materials 1 1/2 km. to the south, close to the present coastline. Fort Provintia, in which the consul Swinhoe saw the Chinese temple in 1863, and which was built as a protection against the maleficent influences of the wandering spirits of the hung maó ("redhaired," the Dutch), has also been demolished since that time. It had long before been absorbed in the big irregular rectangle of Tai-uan-fu.

6: Kirchhoff--35 [3] U-4 (no date) 1895 Formosans-1-2
116, 133, 361

It is therefore [MC: in view of the decline of Tai-uan-fu as a commercial city] natural that the greater part of the export trade of South Formosa should have gone over to Ta-kaô, 40 km. farther south, which has been connected telegraphically with Tai-nan since 1874. This small but important port is reached by passing between two precipitous cliffs that can easily be seen from far out at sea; on the left rises the Ape Mountain (of coral limestone) to a height of 400 m., and on the right there rises even more precipitously a cliff 120 m. high, called the Saracen's Head after the English cannonboat that surveyed the west coast of Formosa some decades ago. Between these two heights, which are occupied by forts, even smaller steamers can enter a bay which, however, is of very limited extent, and which is surrounded on either side by the installations recently constructed by the Europeans: immediately behing the fort at the foot of the Ape Mountain is the quay alongside which ships lay to, the customs, the English consulate and the dwellings of the foreign traders, while opposite (that is, behind the Saracen's Head) can be seen the hospital of the Presbyterian mission station, transferred from Tai-nan to Ta-kaô, the hospital doing a great deal of good, and the European warehouse. The very shallow lagoon, which stretches out from this harbor to the southeast, parallel to the coast, is separated from the sea by a sandy tongue of land (which first attached the Saracen's Head to the mainland). On this tongue of land is a fishing village with between 1,500 and 2,000 inhabitants, and called Ta-kaô after the harbor. Beyong the lagoon the glance passes over stocks of bamboo, palm and mimosa in the

foreground, and then over an intensively cultivated plain with small villages peeping from amidst the green sugar-cane fields, finally reaching the hazy blue mountains. In this coastal plain, which stretches out farther than the eye can see to the southeast, there lies the town of Fung-schan and, beyond the mouth of the Tan-tschui-ki, Pang-leaô, the center for the junk traffic of this southern region. When the southwest wind develops its full force, no vessel can lie to on this coast, which is most immediately exposed to this wind. The most southerly town on Formosa, which was founded quite recently, is Heng-tschun, the capital of the southern region of the same name, distinguished for its huge rice harvests. It lies at the foot of the western chain of the southern tongue of land.

6: Kirchhoff--35-36 U-4 (no date) 1895 Formosans
116, 133, 361

Rather farther inland is the group of towns of the North Formosan Tam-sui River region. The harbor [36] of Tam-sui consists only of the mouth of this river. The entry into the harbor over the constantly shifting sandbank, because of the strong surf this causes, is free of danger for steamers only in calm weather and when the tide is high. The channel of the river, which flows in a northwesterly direction at its mouth, is deeper on the right-hand side, while the bed is exposed at low tide on the left-hand side, for far more than half the width of the bed. Consequently all settlements are found on the right bank. Once the bar has been crossed there can first be seen, on the left, the Chinese fort, and then the former Dutch fort, built of red brick, where the English consul now lives, and after this the customs house and the open ground of Huuěi or Ho-be, which only the foreigners call Tam-sui after the river. Busy as the port may be, the spot really consists only of a narrow street along the stream in which only two people can avoid each other. But it is adorned by a Chinese temple born on stone columns and is well situated. Close to the locality there rise amphitheater-like the slopes used as a burial ground. Behind this the sides of the Ta-tun bears peanut and sweet potato fields on the lower parts, among which are strewn Chinese farmhouses, and from a height of 500 to 600 m. forests consisting of bamboo and tree ferns.

6: Kirchhoff--36 [2] U-4 (no date) 1895 Formosans
116, 133, 361

Bang-ka ceased to be a seat of administration since the foundation, in 1879, of Tai-pe (or Ko-ping) as the center of administration in North Formosa, in the densely cultivated plain between Bang-ka and Tua-tu-tia, and at almost equal distances from the two towns. The whole fruitful but marshy plain of the three towns has only unhealthy, brackish water, but it receives good water from the southeast from the mountains behind the village of Kieng-be, through an artificial connection that was laid down quite a long time ago.

Beyond this fertile plain there soon begins the still little known land of the "wild savages," the Tsche-huan. Here Sintiam and Tokoham are the most advanced posts of civilization. The two sources of the Tam-sui called after these towns rise in the wooded mountain regions not yet subject to China, but finally flow through rice, sugar-cane and sugar fields... The Tokoham River in particular forms a sharp line of cultural demarcation: to its left are vivid green tea plantations and rice fields along all the heights as far as the sea, and on the right stretches out dark primeval forest.

6: Kirchhoff--36 [3] U-4 (no date) 1895 Formosans
116, 133, 491, 493, 501

A much used road leads from Tam-sui to the most important port of Ki-lung. Although it is hardly half the distance as the crow flies, one travels 52 km. up the winding Ki-lung River on the flat-bottomed boats mentioned above (as in the Philippines the natives call them banka) manned by two rowers who are helped by a third for the stretch with rapids. A number of small localities border the river, whose lower course is so shallow that the rising of the tide in it can be distinctly seen. But then follows a series of rapids in the mountainous region. Travel by boat ceases where the river comes to within 5 km. of Ki-lung Port; one transfers to the sedan-chair used in Formosa, where there are no carriages, and via a pass 200 m. high one goes down the steep mountainside facing the sea to the . . . bay with its coal-bearing surroundings. Here, by way of exception, the entry into this natural harbor is without danger even for ships of greater draught, in spite of its being hemmed in by coral reefs, and the protection against storms in this bay amidst mountains is almost complete on all sides. Nevertheless no steamer can reach the town of Ki-lung, for the shore in front of this locality, which is situated at the back of the bay, is extremely soft, forming a morass at low tide traversed only by a narrow channel leading from the anchoring place. This softening is steadily increasing, for here as in the other Formosan ports the Chinese Government is doing nothing to prevent the junks' evil practise of dumping their ballast right in the anchorage.

7: Joest--56 E-5 (no date) 1882 Formosans
116, 133, 361, 504

Unfortunately, there are no large harbors on Formosa, or rather, there are none in those places where the Chinese companies have trading posts. Taiwanfu is situated two miles from the coast; the harbor, Amping, is situated at that point where Nova Zelandia was situated formerly, but even there landing facilities for passengers and goods are very poor.

7: Joest--56 [2] E-5 (no date) 1882 Formosans
116, 133

The entire western coast of Formosa has been raised; the process, which has been taking place for centuries, is slow but the differences may be clearly seen. In those places along the shore which are now dry the Dutch captains of former times anchored their ships; Nova Zelandia is now five miles from the sea, while formerly the waves had splashed against the walls of this fort, and on the marshy, sandy area of land formed since then there is now a fishing village. There is a dangerous coral reef in the harbor entrance at Amping and there are so many shoals that the passage is not navigable if there is even the slightest breeze; the passengers must land by means of small floats of a peculiar construction which the natives call Catamarans.

8: Chen--438 N-3 (no date) 1951 Formosans--1-2
116, 133, 241, 311

# "LAND UTILIZATION IN FORMOSA*

* Owing to limitations of space, the text of this article has been considerably condensed from the author's original manuscript, and several tables have been omitted. Also, the difficulties of time and distance have prevented the author from seeing galley proof. --Edit. Note.

Cheng-Siang Chen

Land utilization in Formosa is severely handicapped by the topography. Forest-covered mountains rising to impressive heights form a central range, which extends like a backbone the entire length of the island. Only 36 per cent of the land is utilized, and only 24 per cent of this is cultivated.

According to the comparatively reliable statistics of 1947, the total area of utilized land is 1,290,132 hectares, of which 66 per cent is cultivated (paddy fields, 41 per cent; dry fields, 25 per cent). Considerable changes have occurred during the last 20 years or so Table I (1). The percentage of paddy fields has increased, and that of dry fields

1. All tables are based on data contained in the Taiwan

Agricultural Yearbook, Dept. of Agriculture and Forestry, Taipei.

has decreased, as a result of the development of irrigation and drainage. The progress of economic forestation is reflected in an increase of the forested land; the growing popularity of cremation has reduced the burial ground. Land in railroads and highways has also increased, because of the expansion and development of communications."

8: Chen--439 N-3 (no date) 1951 Formosans
116, 133, 311

"The distribution of land use (exclusive of cultivated land) among the hsiens [EJ: i. e. the administrative districts of Formosa] is an index to their geographic characteristics. For example, 56 per cent of the irrigation ditches of the island are in Tainan, a percentage obviously related to the great Kianan irrigation system; and 70 per cent of the irrigation ponds are in Hsinchu, because the topography of the Taoyuan alluvial fan, in the northern part, makes it suitable for damming. Ninety-six per cent of the piscicultural ponds are in Tainan and Kaohsiung, because the waters off the southwest coast are shallow and there are many lagoons and narrow inlets that can be converted into piscicultural ponds; and 89 per cent of the salt fields are in Tainan, whose coastal plain, low, very dry, and with brilliant sunshine in winter, offers good natural conditions for saltmaking. And in Penghu hsien burial grounds occupy 10.3 per cent of the utilized land, both because the Pescadores Islands are the earliest-developed and most densely populated area and because the meager land is unsuitable for cultivation (more than 60 per cent of the inhabitants are dependent on sea fisheries for sustenance).

8: Chen--446
116, 132, 133



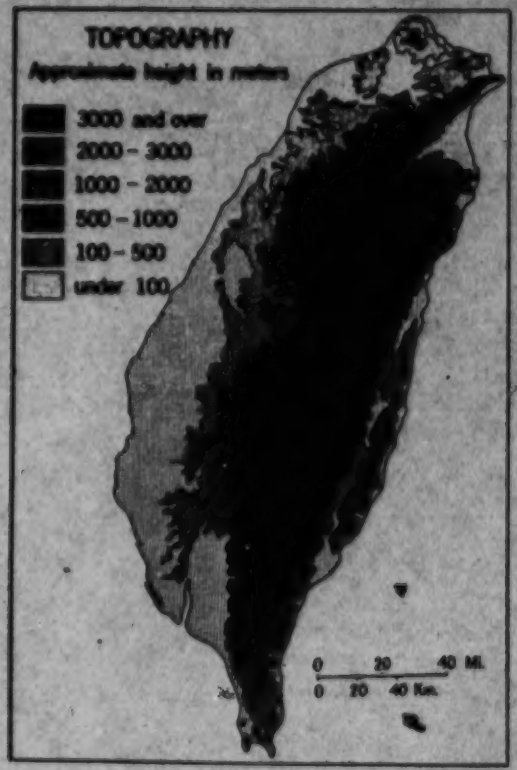


Fig. 2

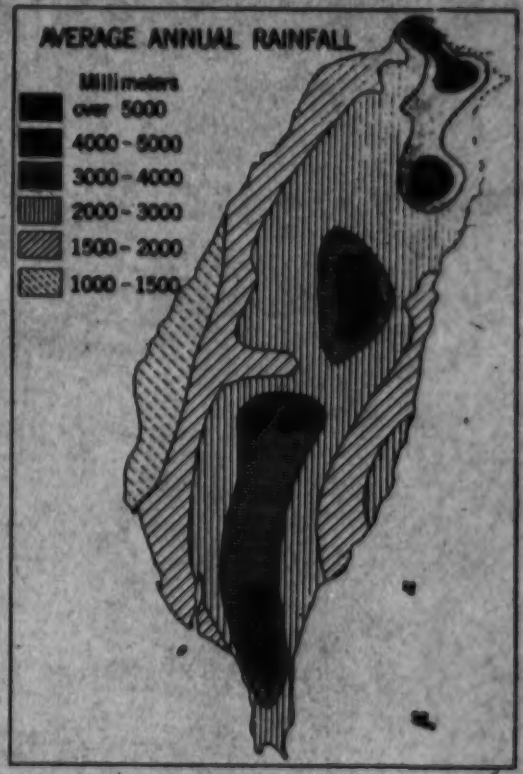


Fig. 3

9: Yamasaki--221-222 ; N-5 (1896-1897) 1900 Formosans 116, 133

The topography of Taiwan island is pretty regular and simple. The chief watershed extends longitudinally from Bitōkoku or Cape Pitaûat at the northeastern end through the island as far as the southern point of Garampi, but does not always follow the crest of the folded mountain range, which takes the same direction. This range—we shall call it the Niitaka Chain after its highest peak and the Central Chain from its position with regard to two other smaller chains—begins at [222] the northeast coast near Dom-Kaku (Cathedral Spire) and first turns WSW towards Setsu-san (Mount Sylvia, 3424 m.) on the watershed, and then along this to the south as far as the southern point. It is not a volcanic formation, as was formerly thought, but a folded range, consisting chiefly of old schists and crystalline limestone. About halfway along the chain there rises Mount Morrison (4145 m.), which we now call Niitaka-yama. Its peak consists of dark clay slate and it is the highest in the Japanese Empire.

To the west of the Central Chain and parallel to it by tertiary formation there extends a second mountain chain, which begins at Bito-Kaku (Pitao Point) and stretches beyond the 23rd parallel to the south. We call it the Kali Chain, after the second highest mountain, the Kali-san (2142 m.). To the northwest of Niitaka-yama a Plutonic elevation reaches a height of 2830 m. in the Tōkan-san.

The third mountain chain also dates from the Tertiary age and extends in the same direction as the other two a distance of 60 km. along the east coast from Pinan to Karenkō. It is separated from the chief chain by the longitudinal valley of the Karenkō, Shūkoran and Pinan Rivers. We call it the Taitō Chain (East Taiwan Chain).

Strictly speaking, the Niitaka and Kali Chains, like the strike of the strata, run from ENE to WSW in the north, and then gradually change to run NE to SW, and finally from north to south. Consequently the chief range forms a curve whose inner or concave side is turned to the Pacific Ocean, while on Honshū (the chief Japanese island), the steep concave side faces the Asiatic mainland. The eastern side or inner declivity of the main chain is very steep, and the foothills of the chain sink rapidly to the plain of Taitō (East Taiwan) or directly to the sea. From here the limestone layers that form a mighty zone on the upper part of the declivity are an imposing sight, and this is enhanced, when, as often happens, a bank of cumulus cloud floats quietly in the air beneath it. At the place on the east coast between Soō and Shinjō, where the chain ends, it appears as a splendid cliff which rises precipitously out of the Pacific to a height of not less than 1,100 m., and is doubtless one of the finest sights on the island.

The chain has many high peaks, most of them not yet climbed. Among these there rise, on the southern side of the plain, Kapsulan, and, in the northeast of the chain, Taihaku-san (1,052 m.), Taigen-san (1,182 m.), Taiko-san (1, 431 m.,) Jūsampun-san

(1,432 m.). To the southwest of them is seen the Setsu-san or Snow Mountain, which is known as Mount Sylvia on European maps and is 3,424 m. high. Farther to the south there follow, on the watershed, the Piroku-san, Gōkan-san and Nōkō-san. Situated to the west-southwest of these, one branch of the Kantōban-san reaches the main chain at the middle course of the Dakusui-kei, with a height of 3,017 m. The connecting mountain of Bun-sui-rei or Chūkai-rei, which leads over the chain from Linkihō to Basshishō, is 3,240 m. high. The enormous, circus-shaped limestone crag on the western part of the crest of Basshishō rises to a height of 2,148 m. The crest extends rather in a southwesterly direction with the high peaks of Shūkoran-san, Tandai-san, Gundai-san to Niitaka-yama. The last attains a height of 4,145 m. and is the highest peak on the island. Formerly it was named Mount Morrison, after an English captain. As the highest Japanese peak it was given its new name, which means 'new high mountain,' by the Emperor himself. The geological specimens brought back from the peak in 1896 by Lieutenant Saitō and Dr. Honda, who were the first to climb it, showed me that it, too, consists of the excellent black clay slate that forms the main ingredient of the Central Chain. A path leads from Chinran-kei, a lateral valley of the Dakusui-kei, over the eastern declivity of the Hattsūkan, to Bokusekikaku in the longitudinal valley east of the folded range.

Farther to the south there is another pass on the Pinan-shusan. This is 2,925 m. high, and the route from Ban-shoryō to Shinkaiyen leads over it. Chiponshu-san,

Gadōsan (2,760 m.), Mutō-san (2,912 m.) are other imposing peaks lying farther south in the chain. But then the highest place on the connecting mountain (Übergang) between Hōryō and Parōye is only 1,405 m. high. Here the island is only 30 km. broad, and to the south it becomes even narrower; at the same time the range sinks gradually towards the south, to the sea. The clay slate disappears and is covered with Tertiary layers, in which Riryū-san (1,224 m.) and Rōbutsu-san (693 m.) rise. The southern end of the island consists of a hilly, coral limestone landscape, in which the prominent mass of cliff Tai-seki-sen ("large stone point," 296 m. high) is well known.

With regard to geological structure, the deepest part of the main mountain chain of Taiwan consists of crystalline slate, stretching out in the form of a long, narrow zone at the eastern foot. Thanks to the geologist Dr. Ishii, who made a cross-cut through this zone on the Basshishō, we learn that the lowest layer of these archaic rocks consists of sericite schist. Over this is graphite chlorite schist, which is covered in its turn by chlorite schist. In addition actinolite schist and graphite schist are found as gravel. These stones must be classed among the Japanese "Sambagawa" layers.[223] Over them come the mightly layers of crystalline limestone and clay slate, which are held to be Paleozoic because of their petrographic nature, although so far no petrifications have been found in them.

The western side of the chain is not so steep as the eastern side, with the exception of the places where it is cut across by deep valleys such as the Dakusui-kei. The schist range gradually, by means of ever lower ridges, changes into a Tertiary range, and towards the west this in turn changes into a rather wide plain, whose coast is often bordered by dunes. This Tertiary range stretches from Bitō-kaku along the outer side of the main chain towards the south. The northern end of the chain is formed by the Tertiary mountainous region of Kilung, in the northern part of which the eruption of volcanic rocks occurred. It is divided into four mountain ridges by the three longitudinal valleys of the Kilung-kei and the two tributary streams of the Shinten. The height of the two middle subsidiary chains varies between 500m. and 800 m., while the peaks on

the southern subsidiary chain, which stretches west southwest from Sanshō-kaku often rise to over 800 m. When I arrived on the steamer in Kilung Harbor, my attention was first attracted by the curious formation of this young range. The surfaces of the declivities frequently coincide with the surfaces of the layers, and the shape of the mountains is very regular, resembling volumes that have been tilted and shoved next to each other. The chain continues to the southwest via Saiten-san, Sempitsu-san, Goshi-san or the Five Finger Mountain, so called because of its shape (1,044 m.), and Gyūkoki-san (1,575 m.) with a precipitous crag on to the well known Kali-san (2,142 m.). This last is an imposing mountain rising far above the ridge. The Tertiary Kali Range stretches farther to the south with projecting peaks 1,200 to 2,000 m. in height. The continuation of the range in the Taichū or Middle Taiwan is formed by the two high peaks of Shūshū-san (1,396 m.) and Tōkan-san (2,830 m.), which are separated from one another by the gap of the Dakusui-kei, the largest river on the island. The Tōkan-san probably forms a diorite island amidst these Tertiary formations* and is the highest

* For the rivers coming from the Tōkan-san contain diorite rubble.

peak of the Kali chain. Farther to the south the range stretches out to the delta region of the Tamsui-kei. Two tributary streams of the Tamsui-kei form longitudinal valleys along the chain.

Between this mountain range and the low-lying land is to be found the hilly Tertiary region. In the north the Tertiary mountains appear as the western preliminary chain of the Kali Range. It is separated from the main Kali chain by a long and narrow tectonic valley, bestrewn with many Chinese villages. The Kantō-san (831 m.) is the highest peak here. In Middle Taiwan these mountains are sometimes jagged and bare, as a result of strong erosion. The inhabitants of the plain generally call this hilly region and part of the Kali chain Zen-soan or "foreground mountains," and the old high chain Au-soan or "background mountains." Naturally the boundary is not precise.

The rocks found in this Tertiary layer are chiefly sandstone, clay shale and conglomerate, while limestone containing fossils is also found in some places in North Taiwan.

Various kinds of Tertiary sandstone are met with. That occurring in the Kilung Range is coarse-grained, rich in quartz and rather hard, for which reason it is much employed in North Taiwan as a building material. In it have been found Pecten, Arca, Ostrea, Yoldia, Xenophorus, Scalaria, Tellina, Echinoids and Asteclypeus. Orbitoides are also met with in the sandstone of the Gyūto-san on the Kōrō-kei.*

* The following comments have been made on the fossil remains in the limestone collection of Professor Kotō from Reisuikō, Shatokō and Shinbokai in North Taiwan by Messrs. R. B. Newton and R. Holland (The Journal of the Geological Society of Tokio, June 1900, Vol. VII; No. 81):

"The most surprising organism in these microscopic sections is the fossilized seaweed (Kalkalge) Lithothamnium (Dr. Yoshihara found this Lithothamnium limestone also on the island of Yayeyama in the south of the Riukiu group). It appears in large quantities in almost all specimens and is obviously identical with Lithothamnium (Cumulipora) Rosenbergii Martin, from the island of Timor, which is attributed to the Miocene period. The next species of importance is that which Dr. Kotō provisionally described as a species of Linderina. Together with Lithothamnium it forms the great bulk of the limestone cliff, but to classify it definitely is

difficult, on the basis of the specimens available. One of the microscopic sections does indeed seem to show the typical tubular structure of Linderina, and thus Dr. Kotō may indeed be correct in attributing it to this genus. Of the other foraminifera the following may be mentioned: Orbitoides (Lepidocyclina) Verbeeki, N. et H., Heterostegina (?), Miliolina, Gypsina, Textilaria, Pulvinulina, Micheliniana, Globigerina bulloides, Bigenerina, Valvulina (?)."

9: Yamasaki--223 [2] N-5 (1896-1897) 1900 Formosans
116, 133, 135, 314

It is worthy of note that the wealth of the island depends chiefly on the Tertiary mountains. The most important minerals, such as gold, soft coal and petroleum, are found here. The camphor trees also grow in this region, for the most part.

9: Yamasaki--223-224 N-5 (1896-1897) 1900 Formosans 116, 133

In the plain of South Taiwan we notice here and there some small hills, flattened, domed or tabular in shape, which are quite independent of the neighboring Tertiary hilly country. They are old coral reefs, whose geological period, Tertiary or Quaternary, has not yet been determined. Among them we have the Taikō-san (310 m.) Shōkō-san (240 m.), Hampei-san or Pwapen soan (228 m.), Atei-san (54 m.) and Hō-san or Foan-soan (147 m.). The Takao-san (323 m.) on the coast also belongs to this formation, and Shōryū-kyūtō or Lambay Island, which is about 10 km. from the mouth of the Tamsui-kei, also consists [224] of coral formations, so that it would appear that the hills mentioned are recently raised coral reefs.

9: Yamasaki--224 N-5 (1896-1897) 1900 Formosans
116, 133

The third range, which stretches along the eastern coast of Formosa—we have already called it the Tai-tō Chain or East Taiwan Chain—is also very worthy of note. The peaks in this range often rise to more than 1,000 m. The highest mountain , to the east of Kompo, attains a height of 1,550 m., while the next highest, to the southwest of Seikō-wan, is 1,440 m. high. This chain also consists of sandstone, clay shale and limestone of the Tertiary period, and, in particular, its chief constituents are volcanic agglomerate and tuffs. Above this stand some peaksof andesite lava. This agglomerate range is very steep everywhere, as is the rule in many other volcanic regions of Japan, and the detached blocks lying on the coast are often picturesque in appearance, as for example the giant sea-washed black cliffs in Sansendai, designated on maps as "Black Rock Bay." This range is doubtless a small volcanic range, which pushed through a break on the steep side of the central chain. It is thought that it was at first a volcanic island chain which was raised gradually by a secular movement until it became connected with the main island. And there are indeed many indications of this. Together with the tuffs, on top of each other, this agglomerate not only forms a massive complex of strata with the coral limestone beneath and the Tertiary sea sandstone, as can be clearly observed at the mouth of the Shūkoran-kei, but we also find a distinct terrace formation on this east coast, so that the precipitous coast rises in three or more steps. One also notices, on the northern side of the little bay of Sansendai, a coral reef 50 m. above the actual sea level. All these facts show us a tectonic uplift since the Tertiary period, which has not yet ceased.

In addition to this volcanic chain, [MC: Tāi-tō chain or East Taiwan chain] there is another notable volcanic group in North Taiwan, which also pushed its way up through Tertiary layers. In consists of some volcanic cones, among which some prominent peaks are to be found, the Taiton-san and the Shichiseiton-san or Paulon-soan, and consequently we call this group "the Taiton volcanic group." It forms the northern frontier of the Taihoku Plain. To the southeast it is surrounded by Tertiary hills, while in the north its declivities stretch out gradually and gently to the sea. The Taiton-san (1,045 m.), which is in the middle of the group and on the right bank of the Tamsui-kei, is a volcano, doubly conical in shape, whose ejections lie for the most part to the north. At its western foot lies the harbor of Tamsui, also on these layers of tuff. The volcano is no longer active; but the thick layer and the considerable extent of the lava stream and other ejections, which can be clearly seen at the northeast crags, reveal marked activity in earlier times. Another high volcano, almost perfectly conical in shape, is the Shichiseiton-san or Paulon-soan, which is 1,109 m. high. It forms a blunted cone and has a crater on top, surrounded by some small peaks of the broken crater wall. This volcano is not inactive like the preceding; there are many solfataras around it. I saw three of them on the western slope and one at the eastern foot. One of them, situated on the northwestern slope quite close to the peak and the Kimpoli Pass, forms a large horseshoe-shaped depression, which was not inappropriately described by the

term "side crater," and from which steam and sulphur gases are expelled with a loud noise. To the south of this volcano we find another, not so high as the preceding, but quite conical in shape, which is called Sabō-san, i.e. the "Cap Mountain" (711 m.).

In the valley of Kōkei, between the three volcanoes described above, there is a large solfatara. It is situated exactly on the border between the volcano and the Tertiary hill whose slopes rise very steeply opposite the former and rather gently on the other side. Here we are doubtless confronted with a break in the Tertiary range through which the solfatara made its way. It has a considerable area, and many people work there gathering sulphur. Not far off there is a bog from which many hot sulphur springs rise. These springs flow out through a gulley and form a cheerful brook with some water-falls, and here a spa has been built. The surroundings of the Hokuto spa are very pleasant and attractive, and it is now the favorite recreation center for the citizens of the capital of Taihoku, who can reach it after a journey of one and one half hours.

9: Yamasaki--224 [4] N-5 (1896-1897) 1900 Formosans
116, 133

To the northeast of the Shichiseiton-san I saw another cone, the Kōshi-san (890 m.), which is probably an isolated volcano. I was told that there are two solfataras on its northern flank and a hot spring at the foot, near Kimpoli.

Let us now cast a glance at the island's coasts. Taiwan is but little indented and consequently, in comparison with other parts of Japan, it has a modest circumference. For every 1 km. of coast in Taiwan there are 29.5 sq. km. of area (almost as much as in the case of the chief Japanese island, where the relationship is 1 km. to 29.7 sq. km.), while in Kiūshū, which is almost as large as Taiwan, there is a surface area of 10.8 sq. km. only for every one kilometer of coast. In order to consider the coast in a convenient way, we shall first travel from Kilung Harbor along the east coast, then round the southern cape and along the west coast back to the point of departure. The harbor of Kilung lies at the northern end of the island and is the most important for intercourse and trade between Taiwan and the rest of Japan. The harbor bay (Ria) of Kilung is surrounded by Tertiary sandstone hills, and the shore shows many curious small erosional formations, comparable to [226] earth pyramids, which are also formed by the ocean waves, for example the large cave near Image Point.* The harbor is about 3 km. long

*The name "Image Point was given it by an American voyager with the Perry expedition, because of the shape of the earth columns.

and is more than 18 m. deep in the middle. Here at least ten large ships of over 1,000 tons can lie unhampered. But, on the other hand, only small craft, and that only at high tide, can go on to the slimy bottom of the inner part, for at ebb tide this is

uncovered. Unfortunately the mouth of the harbor opens too widely towards the ocean in the north, and is thus not protected against the rolling sea waves, particularly at the time of the northeast monsoon. Apart from this, Kilung is the best harbor on the island, and a project for its improvement has already been submitted to the Government, great hopes being placed on the plan's execution.

9: Yamasaki--226 N-5 (1896-1897) 1900 Formosans
116, 133

A precipitous coast extends from Kilung round the Sanshō Cape as far as the Kapsiulan Plain. But along the plain there stretch dunes which prevent the river waters entering the sea directly. So one can find a river which flows along the inside of the dunes and parallel to them. At the southern end of this stretch there is the small, but deep, bay of Soō (Suao). It is the only good recess on the island's east coast, for in time of storm three or four large steamers can lie quietly at anchor here. Between this harbor and Shinjō, in the Karai Plain, there rise giant crags to a height of more than 1,000 m. ...The shore of the Kirai Plain is also bordered by dunes, and here is situated the harbor of Karenkō or Hōrenkan, which is quite open to the sea and offers no protection from the high waves; even in fine weather it is not easy to enter this harbor. I myself waited in vain for two weeks for a steamer to take me back because of bad weather.

9: Yamasaki--226 [2] N-5 (1896-1897) 1900 Formosans
116, 133, 361

Southwards from Karenkō to Pinan along the foot of the coastal chain, the coastline first proceeds for a few kilometers along the first low hills; then there follows a steep stretch near Kororan, and again a low section with a steep edge lying farther back. The precipitous coast is wonderfully developed between the mouth of the Shūkoran-kei and Pinan. But at times we go through sandy beaches at the foot of the terraces, which are only a few meters high. There are three steps in the coastal terraces, with a total breadth of 300 to 1,000 m., and on this are found the villages and fields of the natives and also of the Chinese who have settled there. Many coral reefs can be seen on the shore.

9: Yamasaki--226 [3] N-5 (1896-1897) 1900 Formosans
116, 133

Seikōwan or Chokonwo is a small haven for small ships and fishing boats only, on the Sansendai Bay. It is quite round, with an average diameter of about 200 m., and is surrounded on all sides by coral reefs. Only a narrow exit to the sea permits sea traffic. On the dunes of the Pinan plain there is a large village of the same name. Thi is the chief locality of the Taitō or of East Taiwan. As for the value of the harbor, it does not differ greatly from that of Karenkō. From the end of the plain to Hachiyōwan, there then lies a far-stretching beach with a steep border. But one always proceeds along a narrow and unpleasant terrain covered with sand and gravel. At times we could walk along the coast only in the short interval between two consecutive waves. Here and there in between, clay slate cliffs sometimes project boldly into the sea. In some instances we had to clamber over the large pieces of rock that had fallen down from the slopes. The southernmost parts of the island consist of hills formed by coral limestone of the Tertiary period (?), and the coast itself is here and there bordered by new corals.

9: Yamasaki--226 [4] N-5 (1896-1897) 1900 Formosans
116, 133

The southernmost point of Garampi and another point called Guswa enclose the bay o
Nanwanor Kwaliang. On the west coast of the small Koshun Plain lies the not exactly
good but well-known harbor of Sharyō (Shajō). From there to the village of Hōryō or
again finds a long beach with a precipitous edge, which gradually flattens out to form a
level coast, then stretching out almost the whole length of the island's west coast.

9: Yamasaki--226-227 N-5 (1896-1897) 1900 Formosans
116, 133, 361, 503

When we proceed northwards from Hōryō, we find a harbor, Tōkō, at the mouth of the Tamsui-kei, a large river in southern Taiwan with a fertile basin. In the harbor, at least twenty large Chinese trading vessels always lie at anchor. Not very far to the north is a lagoon harbor, Takao, which is very famous, both because of its trade and also for the beauty and salubriousness of its location. Between the lagoon and the sea there stretches out a 12 km. long tongue of land, called Haisa ("sea sand"), on which are many fishermen's huts. At the northern end of the Haisa there rises up a crag, called Saracen's Head by the English, which was doubtless separated from the "Ape Mountain" opposite it by erosion of the sea waves. The Ape Mountain is joined by the higher Takao-san (327 m.), which is an important landmark for travelers. A narrow channel between these two hills forms the mouth of the bay and the harbor. Unfortunately the entrance to the lagoon, like the lagoon itself, is shallow so that only small steamers and junks can enter, while the [227] larger ships must anchor outside the harbor. All official buildings and foreign concessions lie beneath the Ape Mountain, while the shops of the natives are grouped opposite, at the foot of the Saracen's Head. This locality is usually called Kigo. Many mangrove trees can be found in the lagoon. They are not so large as those I later saw in Singapore. At some distance from the lagoon shore is the town of Hozan (Fŏngschan), in much the same position as Königsberg on the Danzig Haff. The two hills mentioned, Ape Mountain and Saracen's Head, consist of old coral reefs.

9, Yamasaki--227 N-5 (1896-1897) 1900 Formosans
116, 133, 501

Farther to the north [MC: of Takao] the level coast has many dunes. The large town of Tainan also stands on an old dune. The sea bottom of the corresponding harbor, Anping, is not deep, as is usual in this region, so that wide stretches of the coast are dry at low tide. The large ships anchor 4 km. distant from the wharf and the bamboo rafts peculiar to South Taiwan, and called Katamaran or Teppai, provide for communication between the ships and the land. In addition, the harbor is quite open to the sea: consequently all landing is sometimes suspended at the time of the southwest monsoon. But since, nevertheless, it lies in the neighborhood of the large town and the fertile plain, its commerce has come to occupy the first place in southern Taiwan. This region was known to Europeans from early times.

9: Yamasaki--227 [3] N-5 (1896-1897) 1900 Formosans
116, 133, 503

I have already referred to phenomena of elevation on the east coast; they are also to be seen on the west coast. Not only the presence of many old coral reefs and dunes in the Tainan plain, but other facts also offer proof of tectonic movement in quite recent times. On old Chinese maps we see that the harbor of Anping, which is now connected with the town of Tainan by a piece of level land, was situated on a small island almost until the beginning of the 18th century. It is also said that the Dutch ships, earlier, in the 17th century, lay to at the town wall of Tainan. This wall is now at least 8 km. from the actual anchorage.

There are many other harbors on the long sandy and slimy coast of western Taiwan. They are all unprotected against the southwest monsoon and offer an unsafe anchorage. But Rokkō (Lokiang) in particular is the trading center in the Taichū Plain, for it is nearer than other harbors to the Asiatic continent, and there are piled up in bulk the products of the blessed Taichū Plain. To the northwest of Tonshō one can sometimes see the low edges of Tertiary hills and of even more recent formations on the strand. The northwest coast shows a great development of the dunes. Farther to the north, at the mouth of the Tamsui-kei, there is the famous harbor of Tamsui or, in Chinese, Hobe. Unfortunately the harbor is not good, on account of the many sandbanks which are quite dry at low tide. But since the river basin is an excellent production center for tea and the capital, Taihoku, also lies only 20 km. distant from the river mouth, trade and intercourse with many Chinese ports are in full bloom, particularly with Amoy and Futschu. On the coast we also notice coral reefs, which some people use for lime-burning. Northeastwards from Tamsui stretch out the gradual slopes of the Taiton volcanic group, with low cliffs at the end. Passing round the northern point, which is called Fuki-kaku or Foki, we come to Kilung along the strand which has steep edges lying farther back, this having been our starting point.

9: Yamasaki--227-228 N-5 (1896-1897) 1900 Formosans
116, 133, 312, 505

The Tamsui-kei, which together with its two tributaries on the right-hand side, the Shinten and Kilung, flows through the fertile plain of Taihoku, is important not only for watering the fields but also in communications. At its mouth lies the harbor of Tamsui, already mentioned. From there there always travel many Chinese ships and river steamers 20 km. farther up the river to Tai-tō-tei (Tautuatea), which is the largest freshwater port of Taiwan and is quite close to the capital of Taihoku. The trading vessels [228] can travel another 20 km. to the southeast as far as Taikokan (Takoham), a small town on the border of the native territory. The surroundings of the town of Taikokan are well known for camphor and other forest products. So one can always see many small boats with these products traveling from there to Taitotei on the swift flowing Taikokan-kei. The largest tributary of Tamsui-kei is the Kilung-kei. It flows through a longitudinal valley in the Tertiary range of Sanshōrei, a famous battlefield and a difficult mountain pass. It is about 60 km. long and navigable over most of its extent. Along the upper course of the Tamsui-kei river there are gold fields and bituminous coal deposits. The port of Kilung also lies quite close to the side of a small hill on the river. Thus this small but voluminous river also has considerable importance for transport in this region, where the roads leading into the country are in a bad condition.

9: Yamasaki--228 N-5 (1896-1897) 1900 Formosans
116, 133

The Tamsui-kei of South Taiwan flows from the Central chain in a southern direction, through a large fertile plain on which rice and sugar-cane grow, to Tōkō, a port at its mouth. Small boats can travel pretty far up the river. Some smaller rivers in the southern plain and in the marshy region are navigable, but they have little importance in transportation.

The drainage channels on either side of the Central chain have their peculiarities, owing to the topographical conditions. The waters from the huge steep declivities of the eastern side form numerous but short transverse valleys. In the middle part of eastern Taiwan all the waters of these transverse valleys cannot flow directly through the meridian chain lying on the coast, but turn into the longitudinal valley between the two chains at a right-angle to north or south. The whole narrow Taitō Plain offers passage to these waters. The whole length of the plain is watered by three rivers flowing in opposite directions, their watersheds being only 200 m. above sea level. The river in the north is called Karenkō and the southern river Pinan, both of them having rather a large meadow plain at their mouths. The third, Shūkoran-kei by name, which is also the largest river in eastern Taiwan, has its source in the highest part of the Central chain. Like the Karenkō, it turns northwards into the Taitō Plain, flows along it for some distance and then breaks through the coastal range at Tsuibi and flows eastwards to the sea. The volume of water in this river is usually so small that the natives can drive their large buffalo carts right through the water. Only in the lower course of the Shūkoran-kei is some deep water to be found, on which there travel to and fro the curious little boats that can be carried on land by one adult. The river bottom is always covered by pebbles, with the sole exception of some streams on the northeast coast. The water is generally clear and flows swiftly.

9: Yamasaki--228 [3] N-5 (1896-1897) 1900 Formosans
116, 133

On the western side of the Central chain we notice that almost all the rivers reveal the peculiarity that the waters they have collected in their upper courses divide again after they enter the coastal plain and make their way to the sea in different branches. Thus we always find that the delta at the mouth of these rivers occupies a considerable extent of ground. The water level in these branches is usually very low and the whole area between them is covered with coarse gravel, which makes it very unpleasant for the traveler on the main routes there. In the rainy season, when streams rapidly swell into rivers, these beds frequently change, thus creating a great obstacle for intercourse between North and South Taiwan. The Hōri-kei, whose whole course is about 100 km. in length, has a gravelly area 10 km. wide on its lower course, and a much larger one at the mouth.

9: Yamasaki--228 [4] N-5 (1896-1897) 1900 Formosans
116, 103, 133

The largest river, the Dakusui-kei, has its source in a gorge on the southwestern slope of the Setsu-san (Mount Sylvia). Its clear, burbling water forms in the upper course, a longitudinal valley between the chains in front of and behind the highest range. Approximately in the middle of the island it turns west at a right-angle to its upper course. On the two steep sides of these transverse valleys one can find frequently landslides and falls of rock. Here the water, mixed with the fine particles of clay slate and schist, is very dark, so that the Chinese gave the river the name of Dakui-kei or "clouded water river." The dark grey, foaming water flows farther west to the neighborhood of Linkih where the tributary of Seisui-kei, or "clear water river" flows in on the left. From there it suddenly spreads out over the level plain of central Taiwan and forms a complicated, fan-shaped network of branches, of which the Seira-kei is the most important, continuing in a westerly direction to the sea. The distance between the northernmost and southernmost mouths is estimated to be about 40 km. This is certainly a very curious phenomenon on such an island as Taiwan.

9: Yamasaki--228-229 N-5 (1896-1897) 1900 Formosans
116, 133

Terrace formations are very widespread on the island, and it can often be seen how they originate along rivers. Along the Taikō-kei in the Taichū Plain I noticed four steps, while Dr. Inonye has written about the five-stepped terrace on the Nan-a-kei in southern Taiwan. Imposing layers of gravel are found everywhere on the plateau, proving that [229] in previous times the flowing water had an even stronger effect than today.

9: Yamasaki--229 N-5 (1896-1897) 1900 Formosans
116, 131, 133, 361 Pescadores

Apart from the chief island of Taiwan, there are various subsidiary islands. Among these the Pescadores are the most important. This group consists of about eighty islets and cliffs, situated to the west of Taiwan in the Formosa Channel, between lat. N. 23° and 24° . The Portuguese called these islands Pescadores (Fisher Islands) because of the extensive fishing which the Chinese have practised there for many centuries. The largest island is called Hōkō-tō (Penghu Island). It consists of basalt and coral reefs. On its western side a bay is formed by the two islands next in importance, Hakusa-tō (Pehoe Island), or "white sand island" and Gyo-ō-tō (Fisher Island). This protected area offers an important haven in the stormy China Sea. The chief locality on the largest island, Makō or Mekon, is a small harbor on this bay with about 3,000 inhabitants, to which there must now be added a small Japanese garrison. The harbor is deep and quiet; always to be found there are some steamers and Chinese trading junks, together with a large number of fishing boats. The island is flat and poor in flora. The highest elevation is only 48 m. high. Other islands worthy of note in this group are Kitsubai or "Bird Island" to the north and the Pachan (Rover) group with Pachan and Tsiang, the Kitsu group (East group) with Tōkitsu and Saikitsu and Taisho or "Junk Island" in the south.

9: Yamasaki--229 [2] N-5 (1896-1897) 1900 Formosans
116, 131, 133

To the southwest of Taiwan lies the small coral island of Shō-ryū-kyū-tō or Lambay Island, while to the east of Taiwan the three volcanic islands of Kashō-tō or Samasana, Kōtō-sho or Botel-Tobago and Sho-kōtō-to or Small Botel-Tobago are also counted with Taiwan. Kisho or "steep island," is a small island on the coast of the Kapsiulan Plain. At the mouth of the port of Kilung there are two islands, Sai-rō-to and Kilung-tō; the latter, consisting of volcanic rock, rises steeply from the sea. Farther to the north lie Agincourt and two other islets.

10: Schumacher--223 T-1 (ca. 1896) 1898 Formosans
116, 133

The torrential waters that come down from the mountains flow between Tamsui and Sin-tschu into the river system of the Tamsui which is controlled in various places and is nearly everywhere navigable for junks. In the rainy seasons the rushing Tyka river flows through hard areas of gravel between Sin-tschu and Gosche, but during the dry period its water is diverted into twenty-two shallow creeks and the bed of the river can be crossed on horseback without any danger. The sister-streams Ponkam and Lokkang flow from Tschang-hua to Kia-y; I assume their relationship from the fact that the right bank of the Lokkang and the left bank of the Ponkam are high and that they seem to constitute water-sheds. Between the Ponkam and Lokkang eighteen more or less connected river courses are found, e. g., we have here a system of crossing streams. In contrast to the Tyka they carry water at all times and, with the exception of the Ponkam, after rains they can be crossed on foot or on horseback; but in the rainy seasons they rise and flood all the intermediary land. Beyond Kia-y at almost completely regular intervals of ten kilometers smaller or larger independent creeks are found; neither are they torrential nor do they present special dangers or impediments. All these brooks and streams flow rapidly and partly forcefully over the firm, rocky ground.

10: Schumacher--226 [8] T-1 (ca. 1896) 1898 Formosans
116, 131, 133

Strategically Formosa is highly significant because from here insuperable obstacles may be imposed which would prevent passage through the Formosa canal.

On the other hand, Formosa does not have a single port which might serve as a base for maritime operations and which could shelter modern war-ships. Instead it has good natural fortifications which in the north protect the entrance to Kelung and Tamsui and, in the south, that to Takao. In addition the Dutch and the French have built forts in Amping. In case of war it might thus be possible to maintain traffic between Formosa and the Pescadores, or at least it will be facilitated to a great degree. And the Pescadores have a harbor which we should be inclined to judge one of the best and safest of the world.

While the region near Kelung is very hilly, covered with trees and quite sparsely settled the section around Tamsui is quite different. Red dunes that are overgrown with bushes slope gently down toward the sea and the last mountain spurs give space to large low plains, which are fertilized by the alluvial deposits carried by a number of streams. These broad deep rivers run from one large city to the next and they are dotted with a good many boats. You see fine rice and sugar-cane plantations all through this area.

The mountainous massif between Tamsui and Syauki point and Kelung is clearly delimited by the course of the Tamsui river, which rises east of Kelung in the vicinity of the Sam-Tiao peak. Little is known about the interior of this massif for it has scarcely been explored.

Subterranean forces have been most active in this part of the island. The high ridge running from northeast to southwest between Kimpaoli and Tamsui is an eruptive upheaval which has several volcanoes that are still active; two of them Taitun and Chow-Soan or Vulcan's Peak are over 1.100 meters high.

There are a good many sulphuric springs and some geysers in this region; five of the latter are at the foot of Chow-Soan and you can hear their explosions several miles away. Between Patchina and Kantow [14] a hot river empties into the Tamsui and in some places the water reaches a temperature of almost 100 degrees. There are frequent earthquakes. During the one that occurred on December 18, 1867 the sea withdrew from the harbor of Kelung while parts of Kimpaoli and Patchina were ruined. Tamsui also suffered a great deal from this earthquake which killed several hundred inhabitants of the city. The one on the 25th of September 1881 was also very violent and it lasted over a minute.

The Tamsui harbor is really only the enlarged estuary of the river. [15] It is the port of embarkation for all the Menka products and it has a population of 70,000. The entrance is blocked by a sandbar just two meters below the surface but as the tide rises from 2.10 to 2.60 meters ships that draw an average amount of water can cross it daily. Mountains rising to a height of 500 to 700 meters border the entrance to the estuary, which is marked by a beacon at the end of a rocky reef.

Several fishing villages are hidden in the little valleys along the coast: Alibong and Alilou, Kimpaoli and Masou. They are connected to the Tamsui valley by some mountain trails which have scarcely been explored and which are only known by hearsay.

Three rather important streams feed the river that empties in the Tamsui estuary. The one coming from the Sam-Tiao peak passes near Kelung, and it is the main outlet from the east. As far as Loan-Loan it is a torrent with rapids here and there, but sampans can navigate the water from this point on. It passes through Niaka, Locktou, Switenka, Sikowdjou and Sikkow; then a mile above Patchina it absorbs the Sintiam and Tokoham rivers which have almost as much water as it does.

12: Garnot--15 G-3 (1884-85) 1894 Formosans
116, 133, 503

Kelung is the center of a little coastal basin that has a radius of several kilometers. The watershed is very near the coast. Several more or less accurate maps that were drawn before the French occupation connected the Tamsui to the Kelung river at this point by a canal. As a matter of fact the watershed is more than 100 meters above sea level at its lowerst point near Loan-Loan.

The Kelung roadstead is wide open on the northern side [16] and it is very jagged... Palm and Bush islands are hilly and covered with underbrush; they do not offer much protection from the swell that comes from the northeast so it is difficult and dangerous for boats to anchor there. The roadstead can hold about twenty vessels. Its bottom is not too good for it consists of mud and pebbles. The real port is so choked by alluvial deposits that only junks which draw a very small amount of water can enter it. In the middle of the port there are two little islands covered with dense vegetation, Harbor Island and Turton Island, and they conceal part of the city from the roadstead.

Five valleys run out to it. The first one which terminates at the base of Mount Clement begins three kilometers northwest of it.

The next three merge at the back of the harbor in an estuary which they fill with their deposits; they have formed a muddy delta which holds part of the Chinese city. Although the valleys slope a good deal at first they soon flatten out as their floors have been gradually leveled by the alluvial sediments. The tide is felt for a considerable distance so it is possible for small boats to go up into them.

Finally in the east and on the other side of the roadstead there is another valley placed symmetrically to the one running to Mount Clement; it begins near the northern coast and extends to fort Neuf.

The brook which forms the thalweg cannot be navigated at all.

All of these valleys are covered with rice fields that are dotted with groves of bamboo

and areca trees. Fields of tea a[illegible] sweet potatoes adorn the slopes while the rest is carpeted with dense vegetation.

The Kelung region forms a very distinct massif whose waters flow to a central point at the back of the roadstead; its high summits often reach an elevation of 200 meters in a perfect tangle of ravines, crests and precipices which are covered with dense vegetation. On the other side there are high summits which are separated from the massif by deep valleys; to the east are the peaks called Sam-Tiao and Petao and you can see their rounded summits from Kelung in fine weather; in the south there are the lofty and unexplored mountains which send their waters to the Tamsui river, and in the west you find the long crest of the Taitun and Chow-Soan peaks.

This mountainous tangle is oriented in the same manner as the whole system so it runs from the northeast to the southwest.

The slopes rise in the form of inclined planes that drop steeply in the north or the west. They are so complex that they frequently tested the ability of the topographers of the expeditionary force.

20: Alvarez--248-249 (no date) 1927 Formosans
116, 133

"The Channel of Formosa is famous for its rough waters, being attacked by violent typhoons every year. The many disasters that have occurred on the coast of the island strike terror into the sea-faring people, who have to sail in that always agitated and violent sea of the extreme Orient.

There are no active volcances, [sic] though some of the mountains seem to offer signs of craters now extinguished, such as Mount Taitum, in the northern section, in the district named Kagi. Then also, in Central Formosa and in the southern part, is found the small but yet smoking crater called Rigyo [249] by the Japanese. Proofs of the volcanic soil of Formosa are, we believe, the numerous hot springs of high temperature, the sulphurous springs in the north, and, lastly, the frequent earthquakes."

26: Honda--469 N-3 (1896) 1897 Formosans
116, 133

Mt. Morrison is not only the highest mountain peak of the island of Formosa but of all of eastern Asia. It was first mentioned by an English Captain at the end of the last century and bears his name. But hitherto no one has climbed it since it is located in the midst of the mountain region inhabited exclusively by natives who often show themselves rather hostile. The absence of roads and villages is another factor weighing heavily against such an attempt. In clear weather the white peak of the mountain is visible from the town of Taiwan and the mountain serves seamen as a landmark over great distances. It is located at Lat. 23.5° North.

On the following day [EJ: of the journey toward Mt. Morrison] we marched for six hours to the village of Tom-bū. Our route was along a stream with steep banks; there were no paths or bridges and at times the water reached up to our stomachs. Tom-bū was the last human settlement. Here we had to pick up new provisions. We were able to get some chickens, sweet potatoes, and millet. We left behind a number of porters and all luggage that was not absolutely essential. With four aborigines, who knew the entire region well, we started the actual ascent of Mt. Morrison. After three hours and at an altitude of 5500 feet we found a hot spring on the bank of the river; the temperature of the water was 70° centigrade. Some similar hot springs gushed forth in the stream itself.

Up to this point large evergreen foliaceous woods prevail. But wherever the natives have burnt down the high grass the vegetation is limited to cork trees (Quercus variabilis Bl.), which indeed occupy large areas. [472] From here on we encountered coniferous woods; at an elevation of 6000 feet, they comprised giant Chamacypariae and Crypto-meriae, their trunks having a diameter from six to ten feet. At 7000 feet we reached the zone of splendid fir trees; some of the species had hitherto been unknown to me. The preceding two days of our march had been very strenuous because most of the time we had to wade through the water of a brook flowing between steep banks.

In the morning of the eighth day after a difficult ascent over barren slopes we reached

a grassy area at an altitude of 9500 feet; it sloped slightly to the south, measured several English square miles and constituted a watershed. The peak of Mt. Morrison rose before us in all its majesty. We made a big fire and spent the cool evening in a little valley. At 2 a.m., when the temperature was down to -3° centigrade, we started the final ascent. First we advanced on the north through Tsuga woods and then on the less steep south side with its pine forests; at times we were crossing grassy areas and finally moved along the high ridge itself; this ridge is crowned by several peaks and is covered with sharp rock fragments of argillaceous schists. We reached the summit at eleven o'clock; the cloudless sky allowed us the most splendid view over almost all of Formosa. Far in the east beyond numerous mountain peaks the ocean was visible. And once more the ocean appeared in the west at an even greater distance. We could see the villages of Taiwanfu in the west, and Tainan, Anping, and Takao in the south.

We took some photographs and finished our scientific observations when fog and strong winds forced us to start back. It was dark when we reached our base where we had left behind our luggage, the porters and our companions who had come down with fevers.

We did not have time to hunt deer or wild boars.... Some rain had fallen in the evening, and the water froze during the night so that we suffered a good deal as we were sleeping outside. The next morning all the Japanese had fevers; my temperature was up to 41.5°

centigrade and one of our native guides carried me on his back during the following three days. For this service I rewarded him with an old pair of pants since he had no use whatsoever for money.

I wish to stress the following points of our scientific observations:

1. The common notion that Mt. Morrison is of volcanic origin is erroneous. The main rock materials of the mountain and its environment are argillaceous schists and quartzite. The beds of the former strike with a dip of 70° from EN 10° to WS 10°. Therefore the northern slopes are much steeper than the southern slopes, and rock slides are frequent.

2. The height of the peak is not 12830 feet, as had been determined by means of trigonometric measurements from the sea, but our barometric observations showed that the height should be 14350 feet. It is likely that the peak itself, as seen from the ocean, may be hidden by another summit close to it.

3. At noon of November 21, our barometer stood at 453 mm and the thermometer at 4.5° centigrade with a relative humidity of 90%.

4. We did not find snow anywhere, not even in the rock fissures on the mountain. The notion prevalent among the Chinese of Formosa that eternal snow covers the mountain is due to the white quartz which from a great distance may be mistaken for snow.

5. The mountainland of Formosa by no means everywhere [473] consists of impenetrable virgin forest. The southern slopes of the mountains are often covered with extensive grass areas for which, in part, the fires started by the natives to facilitate hunting are responsible. Through the telescope from the peak, we have observed a good

deal of the mountain region, and have found that at the most forty per cent of the area visible from that position was occupied by forests.

6. Up to an altitude of 1700 feet, the lowland of Formosa is claimed by tropical vegetation among which ficus, pandanus, palm trees, and pineapple are predominant. From here to an elevation of 6000 feet above sea-level, we find sub-tropical evergreen foliaceous woods; camphor trees occur up to 6500 feet and the same is true of evergreen oak trees. At 6000 feet the region of coniferous trees begins; the species found are at first Cryptomeriae and Chamaesyparis then followed at 7000-8500 feet by firs (variety of Picea Glehni), and Tsuga diversifolia Maxim. at 8500-10, 500 feet. Finally from 10, 500 feet to the peak of Mt. Morrison, we find pine trees and juniperus and principally Abies Mariesti.

7. The abundance of water in the mountain lakes makes it possible to follow the watercourses into the region of the fir trees and the wood may be transported down the streams.

8. The exploitation of camphor on Formosa is still at a very primitive stage. If the methods of Kiushiu were employed production could easily be doubled.

9. The aborigines are by no means hunters. Only the chiefs and a few of their subjects go hunting. The main occupation of the people is agriculture. In particular,

sweet potatoes and millet are important products. In addition tobacco and a variety of pea are grown. The system of agriculture is communistic. Its advantages are that nothing is stolen because nobody is permitted to have private property. Both work and harvest are arranged on a cooperative basis.

10. The men are willing workers and like to use axes, which makes me believe that they would be good forestry workers.

## The External and Internal Structure of Formosa.

The structure of Formosa has become known in its fundamental aspects. Until a short time ago, the knowledge was confined to limited information from peripheral points, especially from Takao in the southwest and Kilung and Tamsui in the extreme north. More detailed studies were begun by the Japanese after their occupation of the island. But they, too, encountered difficulties in their research due to the [965] hostility of the wild tribes in the mountains of the inland region and the eastern part and therefore detailed information is yet lacking on some points of importance.

The cartographical representation of the inland parts of the island is still quite incomplete. The coastal regions have been charted long ago on the maps of the British Admiralty. Besides, their flat character in the west was known and their steep topography in the east. Furthermore no one who has sailed along the east coast in clear weather has failed to realize the impressiveness of the rugged forms of the coastal line and the mountains visible behind them. Some of the highest peaks of these mountains were determined in their approximate height from the sea; the most important names are Mt. Sylvia and Mt. Morrison. These mountains are part of the mountain chain projected in an easterly direction and following the longitudinal direction of the island; from it lesser mountain ridges slope down to the low-lying west. That is the picture that until a short time ago found its expression on the available maps.

On the whole this picture has been proved correct by the Japanese explorations, as far as they go. But many detailed particulars have become known by a study of the geologic structure.

External Structure: One of the most important discoveries was that of the strange Taito trough, which sharply delimits the continuous massive of the older mountains on the east side along a completely straight line 155 kilometers long and oriented N 20° E. It is important to realize that it belongs to three river systems separated from one another by low passes (approximately 200 meters in height); two of the rivers pour out their waters at the two exits of the trough, whereas the third takes its way through the Taito mountain chain into which it has cut its narrow valley. This Taito chain is projected towards the east; it is 130 kilometers long and no more than 13 kilometers wide and reaches a maximum height of 1550 meters. It dates from the Tertiary Age and rises as a strange formation next to the old ridge. The settlements of Karenko (24° N) and Pinan (22° 45' N) mark the ends of this projected coastal mountain range. [966]

Between the Taito trough and a line west of it at a distance of fifty kilometers or more in some spots, which has approximately the same orientation, there rises the great mountain chain with its high crests which Ischii has called the Taiwan Mountains. The two dominant peaks, the Setsu-san (Mt. Sylvia, 3424 meters) and the Niitaka (Mt. Morrison, 4145 meters), are located on a line that also strikes N 20° E and passes through

the Kantaban peak (height, 3017 meters). Westward there follow Tertiary mountains. Here again, the orientation N 20° E is observed in the mountain range which Yamasaki calls the Kali chain; it does not serve as a watershed, but instead several rivers of the western slope of the Taiwan Mountains flow through it on their way to the coast.

The line of strike, mentioned N 20° E, is a basic feature of the structure of the Taiwan Mountains. This becomes even more obvious if we consider a factor which is always important for the judgment of mountain formations, namely the character of the small headwaters. Yamasaki has shown himself most conscientious in the charting on his map; the streams that have been definitely traced in their courses are carefully differentiated from those that have not been explored in all detail. It is easy to see that the valleys in the mountains, in so far as they adhere to a longitudinal orientation, strike N 15°-20° E; besides, a feature characteristic of the parallel structure may be observed, namely the connection by short transverse streams. This is very clearly shown by the main river of the island, the Dakusui-kei which crosses the connecting line between the two main peaks and takes its origin from headwaters which flow to both sides of this line in longitudinal valleys. A similar arrangement is found also within the Tertiary Mts. projected towards the west.

South of the Setsu-an, then, in the main section of the mountains, the orographical elements reveal the existence of a parallel structure. The total setup of the mountains, however, deviates, for the main watershed that connects the two principal peaks does

not follow the mentioned direction of strike, but extends in a slight arc, concave towards the west. This eastern regression, which in part obscures the parallel arrangement should probably be explained by the greater amount of precipitation on the west side. For at the time of the summer monsoon, southerly winds prevail whereas in the winter they are northerly and northnorth-easterly. It ought to be added [967] that even in case of equal amounts of precipitation on both sides, the more solid rocks of the east side would offer more resistance to the regression of erosion towards the west than the more destructible rocks of the west side would be able to muster in the easterly direction.

The northern part of the island differs from the structure just described. An east to west watershed extends under 24° 30' N from the promontory of Dom-kaku at the eastern coast by way of the Setsu, which it leaves slightly to the south, to the Kali-san. As far as they are known, the rivers of the northern side flow radially in relation to it, and their beds through the mountains which soon decrease very definitely in their elevation. This area is divided into strips, again arranged radially, all through the action of the streams.

In the attempt to construct the orographical main line of Formosa, either the high rib extending from the Setsu eastward to Dom-kaku has been taken as a starting point or the lower rib running northeastward and ending in Cape Santiau (the Sanschō-kaku of the Japanese). To it the cuspate watershed mentioned was added from the Setsu to the

Niitaka; from the latter mountain, the line was continued along the watershed, first S 20° W to the Nantaibu and from there meridionally to the southernmost promontory. Thus the idea of a mountain curve convex towards the west and slightly concave towards the east could develop.

Naturally the character of the divide line cannot be a decisive factor in a consideration of the morphology of the old mountain formations of Formosa because it has definitely been subject to erosive activity.

27: Richthofen--967-973 N-4 (no date) 1902 Formosans-1-9
116, 133

Internal Structure of the Older Mountains. Japanese geologists have determined definitely that the fundamental formation of the Taiwan Mts. is distinguished in its structure from the outer and later parts. In the east it ends almost abruptly at the straight line of the Taitō valley. If this line is continued beyond the two ends of the valley, it marks the approximate extent of the other parts of the eastern coast. Only in the north are two promontories slightly projected beyond it. Passing over more than two degrees of latitude from Paroye (22° 22') to [redacted] (24° 36') it marks the sharply defined eastern slope of the older mountains. Observations were made around Soō. The coastal strip with a length of 50 kilometers that extends from there to Schiyō by way of Cape Dom-kaku seems to be completely unexplored. It is renowned for its high and precipitous rocky descents that have an altitude of more than 1000 meters. Otherwise studies have been made of the entire line. [968]

The most valuable clue as to composition is found in a transverse member of the mountains which Ischii has charted between 23° 35' and 23° 48'. It starts at Bassi-schō in the Taitō valley and runs westward across the Bun-sui-rei pass that has an altitude of 3240 meters. But even previously, at an elevation of 3150 meters, the impressive ridge of the eastern side is reached; it stretches in great length and is formed by a thick layer of white crystalline limestone. Ischii started his observations at the foot and noticed a continuous western dip and mighty strata of sericite schists, graphitic-chloritic

schists, and chlorite schist (enumeration from the foot up). He calls this system of layers "crystalline schists" and puts it in parallel with some of the Archeozoic formations of southern Japan. Then follows the crystalline limestone and, above it, argillaceous schist in which the pass is found. Ischii assumes that these two formations date from the Paleozoic. Others are inclined to think of the limestone as belonging to the Archeozoic and the argillaceous schist as dating from the Paleozoic. No traces of fossils have ever been found. Argillaceous schist prevails completely in the entire western part of the section.

When we consider the mentioned formations of the strike we find that the crystalline schists constitute a continuous zone along the eastern slope of the mountains and strike parallel to it, or N 20° E. Northward they continue as far as the eastern mountains are known, i. e., as far as Schiyō and southward close to Pinan. But in the latter case a puzzling strip of argillaceous schist with a steep eastern dip (70-80°) is found adjoining. South of Pinan the only rock formations investigated have been argillaceous schist. Yamasaki crossed several promontories of this type at the east coast.

Ischii claims that the argillaceous schist of the mountain heights describes first an anticline and later on a syncline. Over great distances the mountains are composed of this rock. The high peak of the Niitake (1) is made from it and southward it is known as

1. In 1896 Lieutenant Saitō and Dr. Honda climbed this mountain. They

> brought back some rock specimens which Yamasaki identified as argillaceous schist. But Ischii found diorite in the environment of the mountain and granite close to Mt. Setsu, so that it is possible that the peaks may bear a definite relation to the occurrence of the eruptive rocks.

far as the parallel of Horyō (22° 22' N).

The results of later investigations are available concerning the composition and age of the "argillaceous schist formation." According to reports in Geology of Japan, the lowest rock materials are phyllite, quartzite, metamorphic [969] sandstone and crystalline limestone and the thick strata of argillaceous schists are not found until the very top. Higher up, sandstone intercalations are found in it and in the report the possibility is weighed that these upper formations may be Mesozoic. The difficulties of differentiating them accurately from the Tertiary are stressed.

In so far as the strike of the layers in the Taiwan mountains have been investigated and reported, they confirm the agreement with the strike assumed for the outer part of the mountains in the central and southern parts of the island. Some deviation in direction is found in the north. For the great precipitous descents at the Cape Domkaku, in spite of the fact that the line of descent is parallel to the direction of strike mentioned, have been

recognized as a transverse disruption of the strata which make up the mountain section that ends in them; this is a feature that very clearly distinguishes them from the slopes leading down to the Taito valley. Studies, however, seem to have been confined to the northern part of the mountains in the region of the triangular coastal plain of Giran. Here, near the small anchor bay of Soō, the strike of the layers is ENE-WSW whereas in the Geology of Japan, which was published later, it is E-W, with northerly folds. Yoschiwara has also visited the spot. In addition to the schists, he observed pyroxenite formations of the type characteristic of the lowest part of the Paleozoic Chichibu layers in Japan. In addition he claims that from here on everywhere in northern Formosa the direction of the strike is east to west.

The study of the deviating structure of the mountain section that ends with the Domkaku contributed a good deal to the assumption of a curved mountain chain concave towards the east. For the opinion now was that the mountains strike WSW around Soō, that there was a turn to the SW farther west, and that at the Setsu there was another change to the approximately meridional orientation of the watershed. The location of the Setsu, however, (W 10° S of Soō and at a distance of 55 kilometers from it) is not in agreement with this assumption, although it can easily be brought in line with the later ideas of an east-western strike. Then we are justified in the thought that we are here dealing with mountains of a structure different from that of the Taiwan Mts., that they [970] strike westward past the Setsu and that they may be interpreted as a

continuation of the Ryukyu curve.

The basic ideas are vital for a definite answer to the question and important for the morphological interpretation. But the regions beyond the borders of the Giran plain and the transitional zone from here to Kilung are inaccessible due to the fact that the land is inhabited by aboriginal tribes, therefore information is lacking. In so far as anything is known, the factors are not in favor of the assumed turn, but rather support the idea of a meeting of two different mountain curves that are harmonically in line with the structure of eastern Asia. A substantiation for this argument can be found in the fact that in the fundamental structure of the meridional mountains, the dip is exclusively to the west whereas in the case of the equatorial mountains it is always towards the north. In the mountain curve that is concave towards the east, we would have to expect the directly opposite dip in both instances.

Towards the north, the width of the equatorial mountain section seems to be slight. Ischii thought that the argillaceous schists extend northward as far as Tōi and that formations of this rock material found in the latter place date from the Mesozoic.(1) Yoschiwara

1. Tōi is located twelve kilometers north of Giran.

discovered Tertiary fossils in them, however. According to his own studies, the boundary between the Tertiary and the older schists lies south of Giran. In his opinion

the Tertiary takes the form of steep folds oriented east to west and accordingly the parts of the island north of about 24° 40' would belong to the Tertiary.

The younger encrustations: As far as we know, the older mountains constitute a ridge approximately fifty kilometers in width, narrowing somewhat in the southern part and oriented from S 20° W to N 20° E; in the north a transverse unit is added in a manner which cannot be clearly analysed. The continuous mass is encased in a mantle of younger formations that have been attributed to the Miocene and are interrupted only at some points of the eastern side. The younger strata have been disturbed and in the direction of the coasts they are in part hidden by later formations. In the northwest and in the Taitō chain they show intrusion or displacement by volcanic rock materials.

The pure Tertiary is confined to the Taitō chain, the mountain ridge that has previously been mentioned as having a length of 130 kilometers, and a width of no more than 13 kilometers, and as rising to a maximum elevation of 1550 meters between the Taitō [971] valley and the sea. It is said to consist of rocks dating from the Neogene. Sandy and clayey layers are followed by some of gravel; above them, in turn, appear volcanic tuffs and conglomerates; the peaks are of an andesite and are probably the remnants of old volcanoes. In various places incalcations of coral limestone point towards coastal formations. Above the present beach where corals are still found, Yamasaki observed three beach terraces. Together they have a width of 100-300 meters and it is here that the few human settlements of this area are found. Yamasaki also observed a coral reef fifty

meters above the sea.

In the narrow southern spur of the island which the Japanese call the Koschun peninsula, the Tertiary is represented by clastic rocks of lesser steepness. The maximum altitude is 1224 meters. Independent and apparently superimposed at a later time are coral reefs which constitute rugged hills up to 296 meters in height, and the two southern foothills.

The Tertiary is developed best on the west side of the island. The long twin rivers at first flow parallel to one another S 20° W, and later join and continue as the Tamsui-kei in the south: they have cut their beds into Tertiary mountains that in some places exceed 1300 meters in height. In its continuation, the northern half of the island contains the Kali mountain chain; it is 1200-2000 meters high and also strikes S 20° W-N 20° E. According to Yamasaki even the Tokansan with its altitude of 2830 meters, from which diorite rubble is washed down, is encased by Tertiary rocks.

In the west, this high Tertiary zone is followed by a Tertiary hilly region--in the northern part it is separated by a longitudinal valley with Chinese settlements--which continues to boast elevations up to 830 meters. The entire Tertiary land of the west side consists of clastic rock formations and is folded in the direction of strike mentioned. Fossils that could be identified have not been found here, nor on the south and east side.

Westward the Tertiary region is followed by the slopes leading down towards the coast; the formations are attributed to the Quaternary. South of Tainan reef, mountains of coral

limestones are included in it; the highest of them is the Takao-san (323 meters) on the coast near Takao. Farther north these features are not found. The large lowland area that claims more than one third of the total width of the island in some places between the twenty-third and the twenty-fourth parallel North, is a stepped plateau. It consists mainly of gravel deposits thought to be Diluvian in date and reaches a height up to 500 meters. [972]

The most intensive explorations have been carried on in the Tertiary region of the northern part of Formosa. For here coal seams near the popular port of Kilung have aroused industrial speculation and, besides, the occurrence of marine fossils in clayey incalcations have been of interest. Yamaschita found eight coal seams in the complex of layers which was in the main composed of coarse sandstones and shales; he was able to distinguish two anticlines and three synclines, all oriented from west to east.

The interpolated layers of limestone are up to ten feet thick. The fossils contained in them have been studied by Newton and Holland, who stress the Lithothamnium rosenbergii Martin which occurs also in the Miocene of Timor and on the island of Ischigaki. Other fossils did not refute this dating. Yoschiwara supplements these studies by his own observations near the east coast. As I stated previously, he found the boundary of the Tertiary south of Giran, and believes that everything north of this latitude dates of the Tertiary and that the mountains are composed of folds striking west-east.

On the other hand, Yamasaki and reports in the Geology of Japan speak of a

southwestern-northeastern direction of strike in this part of the island, and of a turn of the Kali mountain chain in the same direction.

In the very north, the structure of Formosa includes a group of volcanoes which have previously attracted attention. The mountains are composed of andesites and their tuffs; they are located on both sides of the lower course of the northern Tamsui river, mainly in the north. They reach altitudes of 800-1100 meters and exhibit some solfataric action. A connection with the other group of volcanoes cannot be recognized.

The relief of the bottom of the ocean around Formosa is only superficially known since soundings have been limited. On the west coast a good deal of new land has appeared, and here the bottom slants down in a straight line. The flat bottom that has a consistent depth of fifty meters extends furthest just off the delta of the Dakusui-kei. Shallow water is found from here to the Chinese coast. The Pescadores Islands, basalt formations, rise from it and are separated from Formosa by a somewhat [973] deeper channel, although it does not exceed 200 meters. The submarine slope in the east is more pronounced and soon soundings for 1500 meters and 1900 meters did not reach bottom. But the few depths that could be charted on this side indicate that up to the 200 meter line this zone has in some places the fairly considerable width of 20 or thirty kilometers; this is especially true of the region of the steepest descent between Schiyō and Soō and from there to Cape Santiau.

Conclusions about the Relation of the Riukiu Curve to Formosa.

1. According to the available information, the basic structure of Formosa seems to consist of two parts:
   a. The Taiwan Mountains. On the whole, their various mountain units, and their inner strata (with the exception of the section of the watershed) strike N 20° S-S 20° W. These mountains are composed mainly of rocks defined as Archean crystalline schists and a complex of layers predominantly of argillaceous schists thought to date from the Paleozoic. The dip is westward. Not until a western point is reached does the cross-section show a change from anticline to syncline and reveals a structure of great folds.
   b. Mountains extending from Cape Dom-kaku by way of the Setsu to the Kalisan; the strike is E-W and the rocks have been recognized as being of the type of the Paleozoic Chichibu layers. The dip is northerly.
2. The Tertiary mantle corresponds to these two directions of strike. South of the parallel of the Dom-kaku in the Tertiary formations of the west and east side, the strike is always parallel to the structure of the Taiwan Mountains. On the peninsula in the south, the formation seems to be less steep as it lies over the ended-up bed of argillaceous schist. North of the Dom-kaku line Yoshiwara and his assistants observed a strike that was W-E in all instances, but other men claim

that they also found a strike SW-NE.

3. The directions of dip in the old formations of the Taiwan Mts. point towards a thrust ESE whereas in the Dom-kaku chain the thrust was from north to south.
4. The Dom-kaku chain is located in the continuation of the outer curve of the Riukiu Islands and is a component part of it. This curve [974] is broken in the Sakischima group neighboring Formosa and is disturbed in the directions of strike of the inner structure, although the curved line is maintained. The Taiwan Mountains disappear in southern Formosa. There are no signs of a continuation towards the south. But the mountains are so massive that they must be thought of as the lonely remnant of a larger curved folded mountain ridge which, by analogy with all other curved mountain formations of eastern Asia, faced the Pacific with its outer side.
5. The volcanic inner curve of the Ryukyu islands continues westward in the ridge of the Dom-kaku chain. Here the Agincourt Islands and the volcanic group in the west of Kilung belong to it. In back of the Taiwan Mountains the only volcanic formations are the Pescadores; their main axis is again oriented NNE or more accurately N 15° E.
6. The Ryukyu Curve and the fragment of the curve contained in the Taiwan mountains have one characteristic in common, namely that on the outer side a zone of tertiary sediments is piedmont to it. That means that in both cases the basic

structures on the front side are found at a relatively great depth. But it is not possible to decide whether these are areas of marine abrasion on which debris washed down from the mountains was deposited and gradual subsidence went hand in hand with it, or whether the down warping was along fault lines. The latter is more probably on Formosa because volcanic formations are found in the Taitō Mts. In the case of the Ryukyu Curve, they have been observed only in the old volcano of Nosoko on the island of Ischigaki.

7. Later displacements have been of the same type in both curves. The Tertiary formations must have risen at least to their present height above sea level, and erosion must have given them a shape approximating that which they exhibit nowadays. Subsidence followed and the corals formed the reefs at that time, which later were exposed when a renewed vertical shift followed.
8. The Ryukyu Curve and the Taiwan curve fragment are distinguished from the curved formations of the mainland by their concordance of the inner structure and lines of down warping in the parts corresponding to the meridional component. [975] Exactly like the Japanese curve they appear, therefore, as mountains in which the outer shape bears a causative relation to the folding thrust from the inside to the outside. But as a rule only more or less curved tension faults could be recognized with some certainty and they were discordant to the directions of strike of the inner structure.

9. The idea that the structure and tectonic lines of the southern Kiuschiu remained without any influence on the shaping of the Ryukyu Curve but that the later processes of dislocation in its northern part exerted considerable influence on the outer appearance of the southern Kiuschiu, finds its analogy in the relation of the Ryukyu Curve to Formosa. For in the Taiwan Mts. no traces of morphological influence by the processes responsible for the tectonic lines of the Kiuschiu can be recognized. On the other hand, the dislocations which produced the final shape of the Taiwan Mts. and found their most characteristic expression in the delimitation of the old mountain stock by the straight Taitō valley have also broken up the Ryukyu Curve; they separated the Dom-kaku mountain section on Formosa from it and probably caused the disturbances which occurred only in the Sakischima group of the Ryukyu Curve.
10. Thus the factual material increases which allows us to make some conclusions as to a number of the manifold curved mountain formations of eastern Asia north of the 22nd parallel (i.e., with the exception of the Annamite Curve): the normal structure of the parts of every curve that belonged to the equatorial component was completed before the structure of the parts located in the meridional component. When the two were joined to constitute a curve, tectonic processes were active and gave the normal shape to the meridional unit by means

of later longitudinal downthrusts and disruptive longitudinal faults. They also had effect on the equatorial unit of the curve that originally was adjacent in the north and as abnormal dislocations they resulted in unusual transverse members and transversal dismemberment.

31: Hofmann--604 [2] N-3 (1909) 1912 Formosans
116, 133, 231, 241, 311, 342

We travelled from Taihoku by train for 1 1/2 hours until we came to the small village of Toyen. Here the land is almost level and has been utilized to the fullest extent. The extensive rice plantations were green and threw into relief the picturesque houses of the Chinese; these are solid brick houses with a curved roof reminiscent of Buddhist temples. In the canals, for which the tributaries of the Tamsui are utilized, there are numerous tame ducks. In the small ponds one may see grey water buffalo, a domestic animal which occurs in large numbers of Formosa. It cannot be compared to European cattle as regards its usefulness in agriculture, and so far attempts to domesticate it have not been successful. Many times I saw the patient Chinese peasants threatened by the buffalo or saw that the animal had broken loose. Next to the rice fields there are extensive tea plantations. This is the region where the famous Oolong tea is produced. There are also banana and pineapple plantations on a smaller scale. The houses are surrounded by slender bamboo trees, and everywhere one may see betel palms, a tree which grows everywhere on Formosa.

31: Hofmann--605 N-3 (1909) 1912 Formosans
116, 133, 311, 314

From Toyen we travelled for 14 kilometers on a small vehicle on tracks (52 centimeter gauge); two Chinese coolies served to propel the car. We stopped at the steep bank of the Tamsui; the river rages far below, washing over the reddish-brown, muddy banks veined with large, round rocks. The rest of the way we went on foot or were carried in a sedan; the coolies were strong enough to carry these anywhere, always at the same regular pace. Every foot of land here has been utilized. Here and there we saw Acacia catechu trees; the sweet smell of their small, fragrant blossoms penetrated everywhere. The acacia, a small tree barely 10 meters high, is also important for tanning; this tree predominates in the plains of northern Formosa. Towards evening we came to Taikokan. (1) Our chief objection on this journey was to study the camphor production

1. The spelling of place names is based on the Japanese pronounciation; the Chinese use a somewhat different system of names.

of the Japanese Mitsui Company. The company had obtained a concession in the forested regions bordering on the territory of the aborigines. We did not succeed in this at first, since the region around Taikokan is a Chinese agricultural district.

On the following day we advanced [EJ: from Karapen] about 18 kilometers and reached an altitude of approximately 1,400 meters. When we had reached our destination, a point which the Japanese had called Funkiko and which was to form the end station of the [616] future railway, the thermometer stood at 19° Celsius and the aneroid at 1,420 (corrected at sea level). Our way took us through depressions and over elevations. The mountains, which consist of schist, are broken up into numerous steep and narrow ranges. Here and there sandstone lies exposed; in most places, however, the ground is completely covered with vegetation. In the northeast the Tauzan (Devil's Mountain) drops down abruptly. This is an isolated limestone mountain with barren slopes; it has a height of 2,800 meters. Here the vegetation is entirely different from that we encountered on the previous day. Before we entered the subtropical forest of Lauraceae trees we were struck by the beautiful tree ferns (Fig. 3), which attain a height of 10 meters or more, and the large banana trees growing on the mountains (Musaceae) with their huge leaves. Both of these plants, in contrast to the dry bamboo forests, demand a high degree of moisture both in the soil and in the atmosphere while they cannot grow where there are strong air currents. On these elevations there is not even a breeze, which is all the more striking since the valley of Kagi, barely 20 kilometers distant in a direct line, is frequently ravaged by violent typhoons. Everywhere we saw banana leaves which were unharmed; these leaves would be easily torn if there were a strong wind. It is a remarkable fact that typhoons are limited to the lowest regions while above

an altitude of 100 meters they do not occur. Although tree ferns and Musaceae, which usually occur in groups, do not take up much space in a limited region and often grow between other trees in the forest, forests of fern and palm trees must be considered characteristic of Formosa. They form perhaps an example of Tertiary flora; according to a theory now accepted by geologists Tertiary flora; which demands a constantly humid, rainy and foggy climate which is at the same time warm and not windy, once predominated on the earth.

On the second day of our journey we again passed through beautiful Lauraceae forests; the most attractive scenes, however, were reserved for the third day, when we covered the distance from Funkiko to Goten (2, 220 meters). On that day we crossed two mountain ridges so that we could reach the plateau of the Arisan mountain [617] by the shortest possible route. The region between 1, 000 and 1, 800 M. is covered with foliaceous forests; here as everywhere else camphor trees grow only singly, while evergreen oaks, Quercus gilva, acuta, etc., predominate, as well as Pasania cuspidata. Cinnamonum pedunculatum, Machilus Thunbergii. All the foliacious trees here are evergreen. There are huge tree trunks overgrown with epiphytic plants; the tops of the trees form an almost impenetrable roof so that neither rain nor sun is admitted here. The average height is over 30 meters. In this hothouse atmosphere there are numerous lianas which grow to great heights and develop strong aërial roots the size of an arm; they are suspended from the tops of the trees on which they live.... The lower

arboreal flora has its habitat among the tree tops. There are large white orchids and ferns, and on the long branches of the crown and the sides of the Lauraceae trees there are groups of hart's tongues. All of these plants...are engaged in a continual struggle for light. Our coolies were very careful not to step into the shrubs along the paths, where a dangerous venomous snake with green coloring has its habitat.... The densest part of this forest is found in the depressions and on the lower slopes. In the higher regions the forest is less dense and there is more light for the plants to develop so that even those on the ground are not hindered in their growth. There are various types of shrubs, among which the Fatsia, with its large digital leaves is especially striking. Gradually the Lauraceae grow further and further apart and less tall. At an altitude of about 2,000 meters conifers begin to appear, first singly and gradually growing taller and more numerous. These consist of species of Chamaecyparis; the evergreen foliaceous trees take the place of underbrush while these predominate. [618] After the gigantic proportions of the jungle through which we had just passed we did not immediately become aware of the size of these trees, which have stood for so many centuries. It was not until we took measurements that we realized that these must be among the tallest trees anywhere in the old world. There are some which grow as tall as 60 meters. The largest of the Chamaecyparis formosensis have a diameter of six meters;

they are about 52 meters high and furnish 280 cubic meters of timber. (cf. Fig. 4). A single tree thus offers more timber than a hectare of old pines in central Europe.

The largest trees may be found in the vicinity of Goten, which is to be the end station of the railway, where the Japanese have already built several houses. Here there is a wide, almost level depression with a deep layer of humus which is protected from the wind on all sides; this is an ideal habitat for the conifers, and the trees here are probably as large as those in California. Since 1907 a meteorological station has been set up in Goten...

We spent several days exploring the jungle area around the Arisan, an area comprising 10,000 hectares in all. At a level of 2,400 meters and above the Cupressi predominate. Here the trees do not attain the heights quoted above, but the average height is over 40 meters and the forest is so dense that one cannot see more than a few feet away. One elevation, which has been named Manzaisan, has an altitude of 2,670 meters and is overgrown with reeds; from here one has a good view of the surrounding mountains. There is a thick fog below so that we cannot see the route we had taken the previous day; in front of us, however, lies the imposing peak of Mount Morrison, which, according to the aneroid, has a height of 4,340 meters. The highest point visited by us in this region was the peak of the limestone mountain, Teufelsberg, with an altitude of 2,800 meters. Here the view is obscured by the dense forests.

35: Collingwood--135 D-2 (1866) 1867 Formosans
116, 131, 133, 361

"On the 13th June, 1866, I visited Sano Bay, on the east coast of Formosa, in H. M. S. Serpent, Commander Bullock, proceeding thither from the harbour of Kelung. The object of this visit was chiefly the verification of some supposed dangers in the harbour, which is spacious and not difficult of approach, and, although little frequented, is of importance as the only available harbour upon the whole east coast of the island. Our visit acquired additional interest from the fact that there was believed to be a village in the bay, occupied by the aborigines of the island, whom we were anxious to meet with. We found four villages in the bay: the first and smallest upon the northern side was a mere hamlet of Chinese fishermen, consisting of half-a-dozen cottages upon the hill-side, their boats drawn up on the beach in front. Passing by this, we proceeded up the harbour, and anchored near a sandy beach, beyond which we could see some roofs of houses. All the rest of the bay had a desolate and lifeless appearance, the lofty hills sweeping down to the water's edge, generally densely wooded, and presenting an aspect of wildness, which accorded well with our belief that they were inhabited by the still savage aborigines of Formosa."

42: Schetelig--387 T-2 (no date) 1868 Formosans
116, 133

Above all else I desired to become acquainted with part of the west coast, so I hired a junk to transport all of us, with all our belongings, to the Caponlan Plain, the only piece of land suited for agriculture on the whole northeast coast. This plain stretches out for some miles from north to south and is everywhere dominated by steep and inaccessible sandstone cliffs some 2,000 to 3,000 feet high which form the last spurs of the Central Range. We remained for some days in this very fertile colony which, however, is cut off from the rest of the world.

42: Schetelig--387-388 T-2 (no date) 1868 Formosans
116, 133, 504

The harbor of Sawo is deep, in places 10 fathoms deep; It is protected on the south, west and north, but entry is rendered much more difficult by many sandstone rocks. The place itself appears to be hewn out of the rock, for on all sides the mountains sink precipitously into the sea, and even the small valley in which the village of Sawo is situated is only about 1/4 of a German mile long and much narrower. [388] Behind, in rapid succession, steep mountains rise up, the first chain already rising to a height of 2,000 feet.

42: Schetelig--388 [2] T-2 (no date) 1868 Formosans
116, 133

I had convinced myself personally, by means of several excursions, of the isolated position of Sawo and of the impossibility of finding any connection with the interior. One must picture the land as rising precipitously from here to the highest point on the island. The mountains, up which I went to a height of 3,000 feet, are covered with primeval forest, particularly with camphor wood. Like all mountains in northern Formosa they consist of graywacke and coal-bearing clay schist, and because of their great steepness they give use to quite insignificant but very cold streams.

In one house of this kind in Tokscham, the fortress of an old and immensely wealthy leader, we met with the greatest hospitality that it is possible to show strangers, and from here we made excursions to the camphor forests of the interior as well as up the extremely curious river valley to the south.

Here it is still possible to trace the successive stages that distinguish the history of the formation of the river. On either side the river is surrounded by a plateau some 600 to 700 feet high, and from this various terraces go down to the river itself and show, even today, that formerly the bed must have been extremely broad and deep, though now the water , which the Chinese lead away on all sides to their fields, is rarely more than a few feet above the point of lowest water level, as we found it [392]. So large does the area of evaporation of a once swift and deep stream become owing to the efforts made in cultivating fields and maintaining meadows.

42: Schetelig--392 T-2 (no date) 1868 Formosans
116, 133, 311

The following brief remarks will be made concerning the distribution of heights and plains in the north of Formosa. I have shown that within one day it is possible, from the meeting point of the three chief streams in the Manka Plain, to reach the foot of the mountains in almost every direction. A further day's journey brings one right into the mountains, but generally one is still within the frontiers where Chinese colonists are to be found, and then, after crossing the first and second ridges, one enters the primeval forests. If one considers that, from our observation point near Takau in the middle of the northernmost third of the island and on the upper course of the Tamsui River, 400 feet above sea level, the nearest ranges are 200 to 300 feet high, that from there in a southerly direction mountains up to 5,000 feet high were measured by us and, finally, that the central connecting point of the Central Range, formerly thought to be 12,000 feet, is now known to be more than 13,000 feet with the surveying of Mount Sylvia, and that this highest point on the island is only 2 to 3 miles to the south; considering all this, it becomes clear that everything lying in between must be mountainous, and steep at that, with no tablelands or cultivated plateaus. Yet all the land lying to the north of the lower course of the middle stream, or that which is situated round the Kilung River, is of surprising fertility, as is also the already mentioned Manka Plain which, strangely enough, is irrigated not by the Tamsui River itself but by one of those admirable Chinese artificial systems of irrigation that brings the water from distant mountains.

131 The total area of Taiwan Province covers 13,880 square miles with a coastline of 970 miles. The main island of Formosa is 250 miles long and 60 to 80 miles wide, comprising an area of 13,800 square miles, with a coastline extending 710 miles. The strategic Pescadores, lying between the China Mainland and Formosa and 25 miles from the latter, guard the Formosa Strait and give shelter to distressed vessels caught in the storms that rage often during the course of the year.

## II. TOPOGRAPHY

• 133 About two-thirds of the main island is composed of rugged foothill ranges and massive mountain chains, of which more than thirty summits exceed 10,000 feet above sea level. Only about 35 per cent of the land is under an elevation of 100 meters (328 ft.). The mountains, towering along the eastern coast of the island, run roughly from northeast to southwest. A low flat coastal plain, extending from north to south, occupies the western third.

The major part of the main island is formed by a tilted mass of earth and rock which extends along the central mountains and slopes steeply to the east and more gradually

1: Stanford U. S-4, 5 1956 AD1 Formosa AD1

●133

[Facing p. 3]

•133 to the west. The Central Range, the T'zu-kao-shan Range, and the A-li-shan Range form this tilted block. The Ta-tun group of volcanic peaks occupies the northern extremity; the Taitung Range forms the narrow downfaulted block separated from the Central Range by the Taitung Trench (rift valley).

The main island's strata are mainly formed by sedimentary rock and are vulnerable to erosion. The erosion is intensified by the frequent torrential storms. It is not rare to find swift streams in the midst of steep valley cliffs in the mountainous areas and disastrous seasonal floods on the plains.

The main island lies in a Pacific volcanic belt, but none of the northern mountains or the coastal mountains is active at present. The frequent seismic activity found is believed to be caused by the gradual uplift of the Asiatic Continental Shelf, as a result of which the eastern section of the main island is often heavily affected by earthquakes.

45:Stanford U, S-4, 5 1956 ADI Formosa
ADI
ROZ



## Major Mountains of Formosa*

| Name | Elevation (meters) | Location |
|---|---|---|
| Yü (Mt. Morrison) | 3,950 | Nantou, Chiayi, Koahsiung |
| Ta'u-kao (Mt. Sylvia) | 3,931 | Miaoli, Taichung |
| Tung-tz'u-kao | 3,884 | Nantou, Kaohsiung |
| Hsiu-ku-luan | 3,833 | Nantou, Hualien |
| Pei-hsin-kao | 3,833 | Nantou |
| Nan-hsin-kao | 3,815 | Kaohsiung |
| Nan-hu-ta | 3,797 | Taipei, Taichung, Hualien |
| Kuan | 3,667 | Kaohsiung, Taitung |

* Adapted from China Handbook 1953-54, Taipei, 1953, p. 343.

133 The rivers have short courses and rapid streams. The longest river is the Cho-shui, only 107 miles long. The rivers are usually shallow except in the rainy seasons. The upper streams generally run through steep canyons, but on the plains numerous branches are formed. Because of the mountain floods, rivers on the western plain rise during the summer; in winter, the dry season, river beds are sometimes exposed.

There are two important lakes on Formosa, namely, Jitsugetsutan[1] [Sun-Moon Lake, or Lake Candidus] and Shan-hu Lake [Chia-nan Irrigation Reservoir]. The former is a natural lake found in the geographical center of the island at an altitude of 2,700 feet. The island derives a major portion of its electricity from the waters of this lake. Shan-hu is an artificial lake damming the Chia-nan River at an altitude of 210 feet. It is located just below the Tropic of Cancer.

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1. This is Jih-yueh-t'an in Chinese. However, this Japanese name seems to be more widely accepted in current literature on Formosa than the Chinese name.

133
45:Stanford U, S-4, 5 1956 ADI Formosa
ADI

## Important Rivers of Formosa*

| Name | Length (km.) | Area (square km.) | Course of Drainage (counties) |
|---|---|---|---|
| Cho-shui | 170 | 3,114 | Nantou, Changhua, Yunlin |
| Lower Tan-shui | 159 | 3,310 | Kaohsiung, Pingtung |
| Tanshui | 144 | 2,705 | Hsinchu, Taoyuan, Taipei |
| Tsent-wen | 137 | 1,212 | Chiayi, Tainan |
| Ta-chia | 124 | 1,272 | Taichung |



* Ch'en Cheng-hsiang, T'ai-wan T'u-ti Li-yung [Land Utilization of Taiwan], Taipei, National Taiwan University and Joint Commission on Rural Reconstruction, 1950, p. 6.

## III. COASTLINE AND MARINE FLOOR

133 The long coastline of the main island has very few indentations. The east coast is precipitious, with a fault shoreline connecting Hualien and Suao. For all practical purposes, it has no natural harbor except Suao Bay on the northern coast. The west coast is marked by wide tidal flats and is generally swampy. The sea is so shallow that sea-going vessels have to keep almost out of sight of land and can find ingress only at a few river mouths. These approaches, however, are often choked with sand bars. Kaohsiung, the southern port, is situated in a long lagoon called Kaohsiung Bay. The northern coast is winding, with many inlets. Keelung Harbor is a deep indentation there.

The main island sits on the southeastern part of the China Continental Shelf. Formosa Strait is shallow; the depth is generally under 300 feet and not exceeding 700 feet at the deepest point. However, the sea deepens abruptly along the east coast; it drops to a depth of 13,000 feet only 31 miles offshore.

## IV. SOILS

134 Three distinct types of soil are found in the mountainous area, and two types of alluvial soils exist in the plains.

52:Barclay S-5 (nodate)1954 ADl Formosa ADl



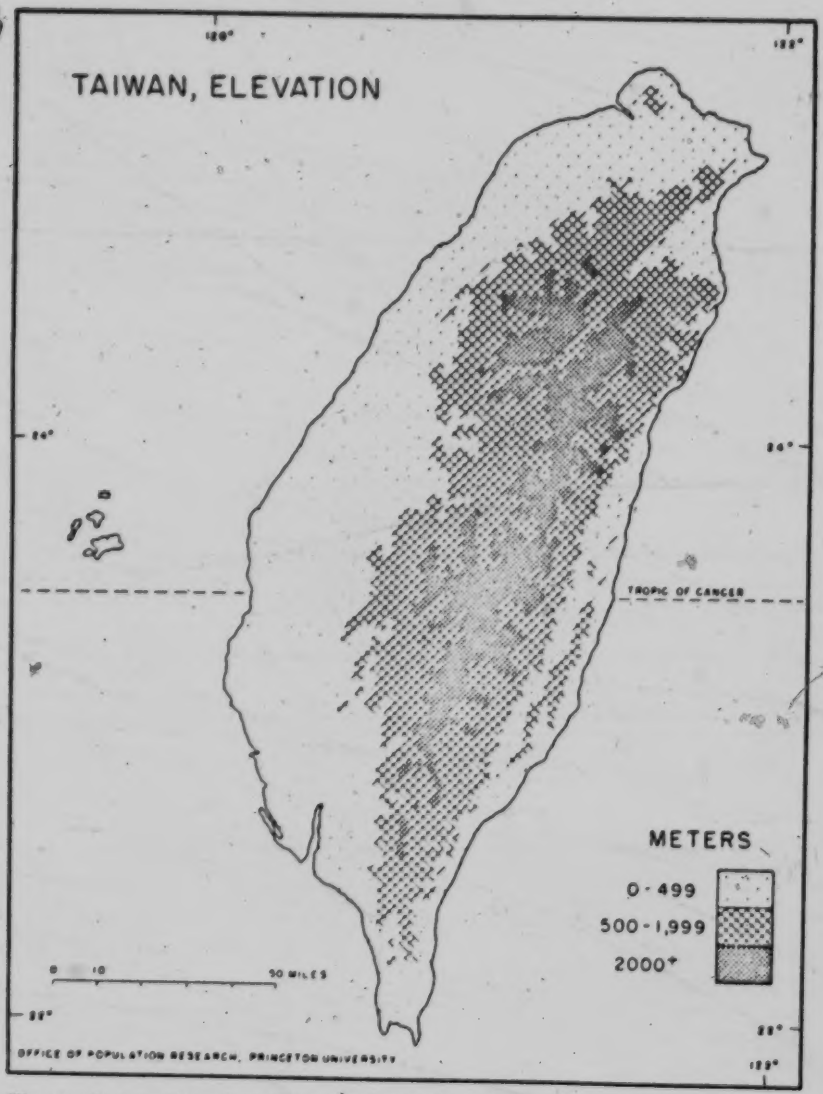


Fig. 1. Topography of Taiwan. (Adapted from Taiwan Provincial Government, Department of Communications, *A Map of the Main Roads of Taiwan*, February, 1950.)

lives of the population. This aspect of Taiwan's history, and of "economic development" in general, receives a surprisingly small share of attention as compared with questions of technological advance.

1:Gallin E-4,5 (1957-1958) 1966
AD5 Taiwan Hokkien AD5
Formosa AD1
People's Republic of China AF18



F P.R.C. 121 369

some insights into what is now taking place on the Chinese mainland. For many of the changes now taking place both in Taiwan and on the mainland are primarily due to the same cause—the encroachment of urbanization on a traditionally agrarian culture, whether enforced by the Japanese, the Nationalist Chinese, or the Chinese Communists.

## FIELD METHODS AND PROBLEMS

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In the selection of a research site, I looked for a Taiwanese village with several attributes. These were that the inhabitants be of mainland origin, preferably descendants of early emigrants from the province of Fukien; that the village have agriculture as its primary means of livelihood; that it have a moderate-sized population, preferably between five hundred and one thousand inhabitants, to facilitate the achievement of familiarity with most of the people and with all aspects of village cultural life; that it be fairly traditional both culturally and socially and as typical as possible of the general villages in that area; and that housing be available inside the village for me, my wife, and our interpreter. It was also important that the village not be too near a major city, and yet not be geographically or culturally isolated from the main flow of Taiwanese life; it had to be identifiable as a definite community.

And, of course, it was important that the villagers be receptive to having a foreign observer move into the village.

It is no easy task to search for a village in which to carry on research in an unfamiliar country. The island of Taiwan, which on the map appears to be minute, is actually 250 miles long from north to south and 90 miles wide; it has an area of 13.8 thousand square miles.

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At the start of my search, I talked with the staff of the Joint Commission on Rural Reconstruction (JCRR), a Chinese and American agency which plays an important role in rural development in Taiwan. They briefed me on the cultural and geographic areas of rural Taiwan, and we decided that the *hsien* (counties) of Chang-hua, Taichung, and Yun Lin (all on the west-central coastal plain of Taiwan) offered the best possibilities for a suitable village. The next step was to travel by jeep within this area with JCRR field agents to visit many different kinds of villages and make a final choice. The interpreter, whom I hired at that time to live and work with my wife and me in the village, was a companion on these excursions. (For a discussion of translation methods and the use of the interpreter in the field see Appendix I.)

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During the time we were investigating the many villages, we also visited local Farmers' Associations and *hsiang* (district) public offices. We held many long discussions with local officials to get additional

1:Gallin E-4,5 (1957-1958) 1966
AD5 Taiwan Hokkien AD5
Formosa AD1



like the railroad lines, were all built during the Japanese occupation.

The mountain ranges serve as a kind of climatic divide. The area north of the mountains, which includes the Taipei region, is known for its long rainy season and cold raw winters. In the area south of the divide, and especially around Taichung and the interior mountain region, the weather tends to be milder, with far less rain and many days of bright sunshine.

On the trip south from Taipei to Chang-hua City the train crosses several large rivers which originate in the interior mountains and flow west to the Strait of Formosa. The rushing torrents of water during and immediately after the rainy season dwindle to a trickle during the dry season, meandering through wide, sandy, and rocky river beds.

At Chang-hua City the traveler must leave the train for a bus headed southwest to the old port city of Lukang. Although the buses leave every fifteen minutes during the day, they are invariably crowded with people and their bundles of produce, fish, a chicken or two, or even building materials.

The thirty-minute trip in an old wooden Japanese bus is made entirely on dirt roads. The ride may be dusty or wet according to the season, but it is always bumpy and noisy. In the dry season strangling dust pours into the bus from all sides. During the wet season, there is always a possibility that the passengers will have to leave the bus and wade while the bus creeps slowly along over the flooded roadbed. Many menthol-distilling factories, brickworks, and small rice mills line the way. The bus must cross many small irrigation canals and maneuver around oxcarts. As the bus moves further away from Chang-hua City and approaches the seacoast area of Lukang, a change in the agricultural landscape, resulting from differences in irrigation systems, becomes more and more noticeable. In those places where there is still no irrigation system, there are large areas of dry fields.

After a half-hour wait in Lukang, the traveler boards another, similar bus for the trip to the village, which lies about three miles inland or southeast of Lukang. The uncomfortable fifteen-minute ride ends when the bus comes to a halt in front of the Hsin Hsing village store.

The houses in the village are constructed of bamboo, mud or fired brick, and plaster. The foundations and structural uprights are usually brick; the walls are a latticework of bamboo strips, filled in with plaster which is a mixture of mud and cow dung. The plaster filling is usually whitewashed. Sometimes the main supports are not brick but heavy bamboo poles. Newer houses, and the older houses of the wealthy, generally have roofs of cement tile, while the oldest and poorest houses have thatched roofs. Houses made of mud bricks are always thatched.